

To Mirtha Capiro/R5/USEPA/US@EPA

CC

bcc

Subject Re: Information from Figure Explanation --Fw: Brief question on Rohm and Haas - symbol from FI figure

Mirtha,

I was told that initially there was some concern as to the exact location of the

French Drain and Slurry wall. This being the case, the plan was to put in a series of borings approximately 1 to 2 feet apart to try to determine the exact

location of these 2 items. I was told that this exercise did not prove to be that helpful. No samples were sent off for analyses.

There is a brief discussion on page 29 of 105 of the Revised FI Report (September, 2004) that talks about the 39 borings.

Let me know if you have any questions or comments.

Regards,

Carl J. Coker Remediation Project Manager

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To

02/15/2006 12:12 PM

Carl J Coker < CCoker@rohmhaas.com>

CC

Subject

Information from Figure Explanation
--Fw: Brief question on Rohm and Haas
- symbol from FI figure

Carl,

In my earlier e-mail I did not quote the text from the figure's "Explanation" for the symbol I mentioned, which is "French drain and slurry wall location soil boring series". Mainly, I would like to know whether that symbol has any additional significance. I would like to know if it is strictly pointing out that some soil borings were collected in that area in the past prior to the FI.

I called you earlier today and realized that you were out of the office for a few days. However, I did not leave a voice mail message. I will be out of the office next week and can follow up with you when I am back. Thanks.

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---- Forwarded by Mirtha Capiro/R5/USEPA/US on 02/15/2006 10:56 AM

Mirtha Capiro/R5/USEPA/ US

02/14/2006 05:11

Carl J Coker < CCoker@rohmhaas.com>

To

CC

Subject Brief question on Rohm and Haas symbol from FI figure

Carl,

I would like to know the meaning of a symbol from Figure 5-24 of the FI Report. The symbol may be used in other figures also, but I have picked that one for simplicity.

- Between wells UAW03-20 and UAW04-20, there is a string of black, interconnected circles. Similar symbol appears next to UAW08-20. What

is that feature?

Hope you can clarify. Thanks

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January 14, 2003

Mr. Peter V. Palena Remediation Manager The Rohm and Haas Co. P.O. Box 584 Bristol, Pennsylvania 19007

Re: French Drain Pumping Test Results
Morton International, Inc. Facility, Reading, Ohio

Dear Mr. Palena:

This letter summarizes the field activities and results of the French drain pumping test performed at the referenced facility (herein, the Morton Facility) during October 2002. The pumping test was performed in general accordance with the French Drain Pumping Test Work Plan (Geomatrix, September 2002) previously submitted to the Rohm and Haas Co. (Rohm and Haas) and the U.S. Environmental Protection Agency Region 5 (USEPA). The objective of the pumping test was to further define the performance characteristics and effectiveness of the French drain. Specifically, it was to evaluate whether the French Drain could be operated in a manner that would effectively contain the migration of contaminated groundwater beyond the western boundary of the Morton Facility. The scope of work included:

- Temporary Piezometer Installation Installation of six temporary piezometers to improve measurement of natural and induced hydraulic gradients in the vicinity of the French drain during the pumping test.
- Pumping and Measurements Pumping of the French drain system at or near its maximum sustainable rate, with measurement of water levels before, during, and after the pumping period.
- Extraction Water Sampling Collection and analysis of samples of water produced by the French drain during pumping, to evaluate water quality parameters. Water quality data will be used in evaluating options for use, treatment, discharge and/or disposal of collected extraction water.

The following provides a summary of the implementation of the French Drain Pumping Test at the Morton Facility.

Mobilization and Set Up

Geomatrix personnel and equipment necessary to setup and perform the pumping test was mobilized on October 13 and 14, 2002. Equipment and materials necessary to perform the test included the pump, piping, valves, flow meters, piping connectors, and temporary water storage tanks.



Pumping the French drain was performed by placing a submersible electrical pump at the base of the French drain sump. This pump was configured to pump through a totalizer-type mechanical flow meter to one of eight 20,000-gallon storage tanks placed adjacent to the sump. Valves on the discharge piping were used to regulate flow rates. A second pump system, using a 3/4-horsepower electrical centrifugal pump, was set up to pump from the storage tanks into the existing Morton Facility groundwater treatment system. A 25-kilowatt generator was used to power both pump systems. The pumps and related surface piping and equipment were installed on October 15, 2002.

The existing pump system routinely used to drain the French drain was shut off and locked out approximately 13 days prior to the commencement of the pumping test. The recovery well, which pumps to the French drain sump, was also shut off and locked out for this period. This was done in order to allow water levels in and near the French drain to return to static levels.

Temporary Piezometer Installation

Eight piezometers (designated PZ01 through PZ08) were installed along the French drain on October 14 and 15, 2002, to monitor water levels in the Shallow Upper Aquifer Sand during the pumping test. Although only six piezometers were proposed in the Pumping Test Work Plan, a total of eight piezometers were installed. Two piezometers were added to improve the monitoring network. All piezometers were constructed of ¾-inch polyvinyl chloride (PVC) with five feet of 0.02-inch slot width mill slotted screen. The installation depth of the piezometer screen was adjusted at each location depending on the saturated thickness of the Shallow Upper Aquifer Sand. At each location, the screen was installed 1 to 2 feet into the clay underlying this sand, in order to obtain maximum submergence for the Troll data loggers (discussed below). The water levels and total depth of each piezometer are provided in Table 1. The location of each piezometer installed is shown on Figure 1.

Water Level Measurement

Water levels were measured during the test using either Troll transducers/data loggers or electronic water level indicator (e-line). Trolls were placed in the French drain sump and selected monitoring wells and temporary piezometers (see below). The installation of the data loggers included calibration of the measurement from the top of the well riser to the top of groundwater using an e-line.

Depth to groundwater was measured in the following wells and piezometers during the pumping test:



Monitoring Locations Measured Using Troll Data Loggers:

French drain sump

UAW03-20	UAW13-20
PZ01	PZ02
PZ03	PZ04
PZ05	PZ06
PZ07	PZ08

Monitoring Locations Measured Using E-Lines:

UAW04-20	UAW05-20
UAW06-20	UAW07-20
UAW08-20	MW EPA-1

On October 15, 2002, Geomatrix personnel used e-lines to measure water levels at all plant monitoring wells, including those designated as observation wells for the pumping test. Pre-test water levels were measured again in pumping test observation wells on October 16, 2002, again using e-lines.

Water level data was acquired using the Trolls from the sump, wells, and piezometers listed above beginning on October 16, 2002 (prior to pumping), and ending on October 22 (approximately 130 hours after the termination of pumping). The Troll data acquisition frequency was one reading per minute. On October 20, after the termination of pumping, Geomatrix personnel used e-lines to measure water levels in the designated test observation wells and temporary piezometers.

Figure 1 presents the potentiometric surface map before the start of the pumping test. Figure 2 shows the maximum drawdown observed during the pumping test. Figure 3 presents the potentiometric surface map approximately 12 hours after the termination of pumping. A graph of water level measurements against time during the pumping test is presented in Figure 4.

Pumping Test

At the start of pumping the sump was pumped at as high a rate possible to remove the sump and French drain storage. Geomatrix planned to reduce this rate as the French drain pumped down, in order to identify and maintain a rate near the French drain's sustainable maximum. The initial water level in the sump was 12.28 feet below the top of the sump manway, and the initial pumping rate was approximately 60 gallons per minute (gpm), based on flow rate estimates described in the Pumping Test Work Plan. Pumping was commenced at 0930 hours on October 16, 2002.

As the French drain pumped down during this initial stage of the pumping test, it became clear that the maximum sustainable rate was likely to be much lower than 60 gpm. During this period of initial drawdown, the following was observed:



- The French drain invert was determined to be at a depth of approximately 18 feet below the top of the sump manway.
- A second water source was observed draining into the south side of the sump, at approximately 16.5 feet below the top of the manway. This apparently represents an extension of the French drain system to the south of the sump. Flow from this source continued throughout the test.

During this initial pumping, it was determined that the pumping rate was likely to be below the minimum range for the 5-horsepower test pump. Pumping was therefore terminated at 1305 hours on October 16 to allow the replacement of the 5-horsepower pump with a 3.5-horsepower pump. 18,880 gallons were pumped during this initial pumping period.

The pumping test was restarted at 1740 hours on October 16, 2002. Pump failure due to plugging with debris occurred on 2116 hours on October 16, and the test was again shut down.

A second replacement pump (a 2-horsepower electric submersible) was installed the following day, and the test was restarted at 1100 hours on October 17. During the test, the water level in the sump fell steadily, and the flow rate was manually decreased as needed to stabilize the pumping level slightly below the invert depth of the French drain (18 feet). Test pumping continued until approximately 2045 hours on October 20, 2002. During the test period, the flow rate gradually fell, from an initial value of approximately 37 gpm to a final measured flow rate of approximately 9.5 gpm.

Test pumping was planned to be terminated on October 21. The generator experienced a mechanical failure, however, and shut down pumping during an unmanned period of the test after hours on October 20. The estimated time of shutdown is 2045 hours on October 20, 2002.

Including the initial pumping period described above, the total pumping test extracted 83,930 total gallons of water removed, and had a duration (actual cumulative pumping time, excluding shut downs) of 4 days 0.3 hours. Figure 5 depicts the pumping rates over the duration of the pumping test.

The recovery period effectively began upon the mechanical failure of the generator. The estimated time of this shut down was 2045 hours on October 20, 2002. Water levels were measured in the observation wells beginning at 0750 on October 21. The troll data loggers continued to measure water levels until October 22, 2002. The recovery data suggests that the French drain has good hydraulic connection to the shallow zone. Water levels in the monitoring wells in the shallow zone at the south end of the drain, or very close to the drain, appear to have responded to the transient condition induced by stoppage of the pump. Levels at the north end, where the saturated thickness is small and the effects of stopping the pump are delayed by the continued flow of water down the invert to refill the sump, were delayed beyond the period of



measurement of water levels. Recovery period water level data is presented graphically in Figure 4.

In addition to the unplanned shutdowns described above, pumping was stopped for brief periods to perform various maintenance functions. These shut downs and events that could impact water levels were as follows:

Day	Time Frame	Event
October 17 th	1935 to 1937	Change discharge to an empty tank and to check the oil in the generator.
October 18 th	1915 to 1917	Change the discharge to an empty tank and to check the oil in the generator.
October 19 th	0200 to 1400	Heavy rain occurred (no system shutdown, may appear as a fluctuation on sump water levels).
October 20 th	0708 to 0711	Change discharge to another tan
October 20 th	1501 to 1504	Change discharge to an empty tank and to check oil in the generator.
October 20 th	1823 to 1826	Change discharge to an empty tank for the night and to check the oil in the generator.

Although these brief shut downs do not affect the overall results of the test, they do appear as short-term fluctuations in the water level measurements.

In addition, the pumping test observation wells were purged and sampled as part of the plant wide groundwater sampling program. Where possible, Geomatrix purged using low flow techniques. Certain wells, however, could not sustain even the low flow purge rates, and were bailed dry for purging, as specified in the Quality Assurance Project Plan (Appendix A of the Facility Investigation Work Plan, Geomatrix, 2000). Water levels within sampled wells will exhibit changes related to this purging and sampling for October 20. The sampled wells are summarized as follows:

- Monitoring well UAW12-20, adjacent to observation well UAW13-20 was purged and sampled from 1025 to 1048.
- Monitoring well UAW07-20 was purged and sampled from 1125 to 1150.
- Monitoring well EPA-1 was purged and sampled from 1225 to 1255.
- Monitoring well UAW04-20 was purged and sampled 1520 to 1555.
- Monitoring well UAW05-20 was bailed dry from 1234 to 1244 and sampled at 1700.



- Monitoring well UAW06-20 was bailed dry from 1252 to 1300 and sampled at 1720.
- Monitoring well UAW08-20 was bailed dry from 1143 to 1155 and sampled at 1610.

Extraction Water Sampling

Two samples of extraction water were collected and analyzed at an off-site laboratory. Samples were collected from a port constructed on the pump discharge line. Extraction water samples were analyzed for a range of analytical parameters, including selected volatile and semivolatile organics, metals, and basic water quality parameters (Table 2). The first water quality sample was collected from the sump discharge at 0945 hours on October 19, 2002 (46 hours and 45 minutes after the final test startup). The second water quality sample was collected from the sump discharge piping at 1105 hours on October 20 (72 hours and 15 minutes into the final test startup).

Water quality was generally similar for the two samples. A summary of analytical results for the extraction water samples is shown in Table 3.

Demobilization

As discussed above, pumping was terminated on October 20, 2002. Demobilization of the pumping test equipment was performed October 21 through October 23, 2002. This included removal of the test pump, reconnection of the existing sump pump, and dismantling of piping, power connections, and controls. The temporary piezometers were plugged and abandoned on October 22 and 23. These piezometers were abandoned by:

- Pulling the piezometer casing and screen using the DPT rig.
- Pushing the DPT drive string into the piezometer boring to approximately the total depth of the former piezometer.
- Placing bentonite cement grout through the drive string, as the drive string was removed.

Water remaining in the storage tanks was pumped into the Morton Facility Groundwater Treatment System. The tanks were removed from the site as they were pumped dry. The final tank was removed from the Morton Facility on October 31.

Results and Conclusions

Based on the data collected during the pumping test, Geomatrix concludes the following:

• Although the southern terminus of the French drain was previously believed to be the recovery sump, there is evidence that there is a source of water infiltration to the sump from the south. Although it was not practicable to measure flow from this new source visual observations indicate that the flow from the southern French drain segment is equal to or slightly exceeds that from the northern segment.



- Drawdown was observed along the entire extent of the French drain by the conclusion of the pumping test (Figures 2 and 3). Although the drawdown along the northern end of the French drain was very small (less than 0.5 feet), the saturated thickness of the shallow UA Sand in this area is also very small.
- Water levels in the monitoring wells and piezometers responded throughout the area around the French drain when pumping of the French drain sump was stopped.
- The long term discharge rate from the French drain is likely to be less than 10 gpm, although this rate may fluctuate with seasonal changes in groundwater flux through the shallow UA Sand.
- The drawdown data from the pumping test suggests that the French drain may be capable of capturing the observed shallow dissolved-phase contamination along the Morton Facility's western boundary. Given the relatively small magnitude of both the drawdown and saturated thickness along much of this boundary, however, it is not likely that more rigorous quantitative analysis (e.g., flow modeling) would provide unambiguous results regarding the capture capability of the French drain.
- Analysis of extracted water detected a number of constituents, including acetone, chlorobenzene, toluene and dichlorobenzenes, and aniline.

In summary, the data suggests that the French drain, if operated at or near its maximum capacity, will be capable of capturing the dissolved phase constituents in the shallow UA Sand before those constituents migrate beyond the western facility boundary. Also, the quality of the extraction water did not vary during the test.

I hope that this report provides you with information useful to your future decisions regarding the Morton Facility. I would be happy to provide you with any additional information that would be helpful.

Sincerely,

GEOMATRIX CONSULTANTS, INC.

Mark P. Hemingway Principal Hydrogeologist

Morton International, Inc.
Reading, Ohio
French Drain Pumping Test Report
Revision: 00, January 2003
Page 1 of 1

TABLE 1 PIEZOMETER INSTALLATION DATA

Morton Facility Reading, Ohio

Piezoemter ID	Depth to Groundwater at Time of Installation	Total Depth
PZ01	12.03	13.90
PZ02	10.98	13.85
PZ03	12.43	14.31
PZ04	11.34	14.34
PZ05	12.24	14.80
PZ06	11.35	14.81
PZ07	12.32	14.81
PZ08	10.29	14.01

All depths in feet below surround grade.

TABLE 2 MONITORING TARGET ANALYTE LIST

Morton Facility Reading, Ohio

Volatile Organic Constituents	Semivolatile Organic Constituents
1,1-Dichloroethane	1,2-Dichlorobenzene
1,2-Dichloroethane	1,4-Dichlorobenzene
Acetone	2-Methylphenol
Benzene	4-Methylphenol
Bromodichloromethane	Aniline
Carbon disulfide	Benzaldehyde
Chlorobenzene	Inorganics
Chloroform	Aluminum
Chloroethane	Antimony
Dichlorodifluoromethane	Arsenic
Ethylbenzene	Barium
Methylcyclohexane	Beryllium
Methylene chloride	Cadmium
Toluene	Calcium
Xylenes (total)	Chromium
Organochlorine Pesticides	Cobalt
Aldrin	Copper
alpha-Chlordane	Cyanide, Total
alpha-BHC	Iron
beta-BHC	Lead
delta-BHC	Magnesium
4,4'-DDD	Manganese
4,4'-DDE	Mercury
4,4'-DDT	Nickel
Dieldrin	Potassium
Endosulfan I	Selenium
Endosulfan II	Sodium
Endrin	Sulfide
Endrin aldehyde	Thallium
Endrin ketone	Tin
Heptachlor	Vanadium
Heptachlor epoxide	Zinc
Isodrin	

TABLE 3 EXTRACTION WATER ANALYTICAL RESULTS

Morton Facility Reading, Ohio

Field Test Method MCAWW/150.1	Reading, Onlo					
Field Test Method MCAWW/150.1	Sample:		Pumping Phase			
Def Cliquid Company	Parameter	Result	Result	Units	Method	
Total Sulfide					Field Test Method,	
Aluminum 87.2 B J 191 B J ug/l SW846/6010B Antimony 3.9 B 3.5 B ug/l SW846/6010B Arsenic 14.2 15.9 ug/l SW846/6010B Barium 256 261 ug/l SW846/6010B Beryllium <5	pH (liquid)	6.97	7.80	no units	MCAWW/150.1	
Antimony 3.9 B 3.5 B ug/l SW846/6010B Arsenic 14.2 15.9 ug/l SW846/6010B Barium 256 261 ug/l SW846/6010B Beryllium <5 <5 ug/l SW846/6010B Cadmium <2 <2 ug/l SW846/6010B Calcium 240000 J 243000 J ug/l SW846/6010B Chromium 5.5 4.1 B ug/l SW846/6010B Chromium 5.5 B 1.9 B ug/l SW846/6010B Cobalt 2.5 B 1.9 B ug/l SW846/6010B Copper 9.1 B 16.8 B ug/l SW846/6010B Cropper 9.1 B 16.8 B ug/l SW846/6010B Copper 9.1 B ug/l SW846/6010B Copper 9.1 B 16.8 B ug/l SW846/6010B Copper 9.1 B ug/l SW846/6010B Copper 9.1 B 16.8 B ug/l SW846/601B Copper 9.1 B ug/l SW846/	Total Sulfide	8600	9600	ug/l	MCAWW/376.1	
Arsenic 14.2 15.9 ug/l SW846/6010B Barium 256 261 ug/l SW846/6010B Beryllium <5 <5 ug/l SW846/6010B Cadmium <2	Aluminum	87.2 B J	191 B J	ug/l	SW846/6010B	
Barium 256 261 ug/l SW846/6010B	Antimony	3.9 B	3.5 B	ug/l	SW846/6010B	
Seryllium	Arsenic	14.2	15.9	ug/l	SW846/6010B	
Cadmium <2 <2 ug/l SW846/6010B Calcium 240000 J 243000 J ug/l SW846/6010B Chromium 5.5 4.1 B ug/l SW846/6010B Cobalt 2.5 B 1.9 B ug/l SW846/6010B Copper 9.1 B 16.8 B ug/l SW846/6010B Iron 1940 1800 ug/l SW846/6010B Lead <3	Barium	256	261	ug/l	SW846/6010B	
Calcium 240000 J 243000 J ug/l SW846/6010B Chromium 5.5 4.1 B ug/l SW846/6010B Cobalt 2.5 B 1.9 B ug/l SW846/6010B Copper 9.1 B 16.8 B ug/l SW846/6010B Iron 1940 1800 ug/l SW846/6010B Lead <3	Beryllium	<5	<5	ug/l	SW846/6010B	
Chromium 5.5 4.1 B ug/l SW846/6010B Cobalt 2.5 B 1.9 B ug/l SW846/6010B Copper 9.1 B 16.8 B ug/l SW846/6010B Iron 1940 1800 ug/l SW846/6010B Lead <3	Cadmium	<2	<2	ug/l	SW846/6010B	
Cobalt 2.5 B 1.9 B ug/l SW846/6010B Copper 9.1 B 16.8 B ug/l SW846/6010B Iron 1940 1800 ug/l SW846/6010B Lead <3	Calcium	240000 J	243000 Ј	ug/l	SW846/6010B	
Copper 9.1 B 16.8 B ug/l SW846/6010B Iron 1940 1800 ug/l SW846/6010B Lead <3	Chromium	5.5	4.1 B	ug/l	SW846/6010B	
Iron 1940 1800 ug/l SW846/6010B Lead <3	Cobalt	2.5 B	1.9 B	ug/l	SW846/6010B	
Lead <3 <3 ug/l SW846/6010B Magnesium 39800 40700 ug/l SW846/6010B Manganese 1550 1580 ug/l SW846/6010B Nickel 46.8 47 ug/l SW846/6010B Potassium 5880 J 5950 J ug/l SW846/6010B Selenium <5	Copper	9.1 B	16.8 B	ug/l	SW846/6010B	
Magnesium 39800 40700 ug/l SW846/6010B Manganese 1550 1580 ug/l SW846/6010B Nickel 46.8 47 ug/l SW846/6010B Potassium 5880 J 5950 J ug/l SW846/6010B Selenium <5	Iron	1940	1800	ug/l	SW846/6010B	
Manganese 1550 1580 ug/l SW846/6010B Nickel 46.8 47 ug/l SW846/6010B Potassium 5880 J 5950 J ug/l SW846/6010B Selenium <5	Lead	<3	<3	ug/l	SW846/6010B	
Nickel 46.8 47 ug/l SW846/6010B Potassium 5880 J 5950 J ug/l SW846/6010B Selenium <5	Magnesium	39800	40700	ug/l	SW846/6010B	
Potassium 5880 J 5950 J ug/l SW846/6010B Selenium <5	Manganese	1550	1580	ug/l	SW846/6010B	
Selenium <5 <5 ug/l SW846/6010B Sodium 304000 307000 ug/l SW846/6010B Thallium 6.3 B <10	Nickel	46.8	47	ug/l	SW846/6010B	
Sodium 304000 307000 ug/l SW846/6010B Thallium 6.3 B <10	Potassium	5880 J	5950 J	ug/l	SW846/6010B	
Thallium 6.3 B <10 ug/l SW846/6010B Tin 2930 3070 ug/l SW846/6010B Vanadium 73.8 74.2 ug/l SW846/6010B Zinc 22.4 67.9 ug/l SW846/6010B Mercury <0.2	Selenium	<5	<5	ug/l	SW846/6010B	
Tin 2930 3070 ug/l SW846/6010B Vanadium 73.8 74.2 ug/l SW846/6010B Zinc 22.4 67.9 ug/l SW846/6010B Mercury <0.2	Sodium	304000	307000	ug/l	SW846/6010B	
Vanadium 73.8 74.2 ug/l SW846/6010B Zinc 22.4 67.9 ug/l SW846/6010B Mercury <0.2	Thallium	6.3 B	<10	ug/l	SW846/6010B	
Zinc 22.4 67.9 ug/l SW846/6010B Mercury <0.2	Tin	2930	3070	ug/l	SW846/6010B	
Mercury <0.2 <0.2 ug/l SW846/7470A 4,4'-DDD <0.25	Vanadium	73.8	74.2	ug/l	SW846/6010B	
4,4'-DDD <0.25 0.028 J ug/l SW846/8081A 4,4'-DDE <0.25	Zinc	22.4	67.9	ug/l	SW846/6010B	
4,4'-DDE <0.25	Mercury	<0.2	< 0.2	ug/l	SW846/7470A	
4,4'-DDT <0.25	4,4'-DDD	< 0.25	0.028 J	ug/l	SW846/8081A	
Aldrin <0.25 <0.05 ug/l SW846/8081A alpha-BHC <0.25	4,4'-DDE	< 0.25	< 0.05	ug/l	SW846/8081A	
alpha-BHC <0.25 <0.05 ug/l SW846/8081A alpha-Chlordane <0.25	4,4'-DDT	< 0.25	< 0.05	ug/l	SW846/8081A	
alpha-Chlordane <0.25 <0.05 ug/l SW846/8081A beta-BHC <0.25	Aldrin	< 0.25	< 0.05	ug/l	SW846/8081A	
alpha-Chlordane <0.25 <0.05 ug/l SW846/8081A beta-BHC <0.25	alpha-BHC	<0.25	< 0.05		SW846/8081A	
beta-BHC <0.25 <0.05 ug/l SW846/8081A delta-BHC <0.25 <0.05 ug/l SW846/8081A	alpha-Chlordane	< 0.25	< 0.05	ug/l	SW846/8081A	
delta-BHC <0.25 <0.05 ug/l SW846/8081A	beta-BHC	<0.25	< 0.05		SW846/8081A	
	delta-BHC	< 0.25	< 0.05		SW846/8081A	
Dictain \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \	Dieldrin	< 0.25	< 0.05	ug/l	SW846/8081A	

TABLE 3 EXTRACTION WATER ANALYTICAL RESULTS

Morton Facility Reading, Ohio

	~46 Hrs Into	~72 Hrs Into			
		Pumping Phase			
Parameter	Result	Result	Units	Method	
Endosulfan I	<0.25	< 0.05	ug/l	SW846/8081A	
Endosulfan II	< 0.25	< 0.05	ug/l	SW846/8081A	
Endrin	< 0.25	< 0.05	ug/l	SW846/8081A	
Endrin aldehyde	< 0.25	< 0.05	ug/l	SW846/8081A	
Endrin ketone	< 0.25	< 0.05	ug/l	SW846/8081A	
Heptachlor	< 0.25	< 0.05	ug/l	SW846/8081A	
Heptachlor epoxide	< 0.25	< 0.05	ug/l	SW846/8081A	
Isodrin	< 0.5	< 0.1	ug/l	SW846/8081A	
1,1-Dichloroethane	<8	<5	ug/l	SW846/8260B	
1,2-Dichloroethane	<8	<5	ug/l	SW846/8260B	
Acetone	210	230	ug/l	SW846/8260B	
Benzene	<8	2.1 J	ug/l	SW846/8260B	
Bromodichloromethane	<8	<5	ug/l	SW846/8260B	
Carbon disulfide	2.1 J	2.2 J	ug/l	SW846/8260B	
Chlorobenzene	120	110	ug/l	SW846/8260B	
Chloroethane	<8	<5	ug/l	SW846/8260B	
Chloroform	<8	<5	ug/l	SW846/8260B	
Dichlorodifluoromethane	<8	<5	ug/l	SW846/8260B	
Ethylbenzene	<8	2.4 J	ug/l	SW846/8260B	
Methylcyclohexane	<8	<5	ug/l	SW846/8260B	
Methylene chloride	9.7 B	1.5 JB	ug/l	SW846/8260B	
Toluene	66	60	ug/l	SW846/8260B	
Xylenes (total)	<8	7.4	ug/l	SW846/8260B	
1,2-Dichlorobenzene	200	140	ug/l	SW846/8270C	
1,4-Dichlorobenzene	27 J	22 J	ug/l	SW846/8270C	
2-Methylphenol	<50	<100	ug/l	SW846/8270C	
4-Methylphenol	<50	<100	ug/l	SW846/8270C	
Aniline	150	91 J	ug/l	SW846/8270C	
Benzaldehyde	<50	<100	ug/l	SW846/8270C	
Cyanide, Total	<10	<10	ug/l	SW846/9012A	

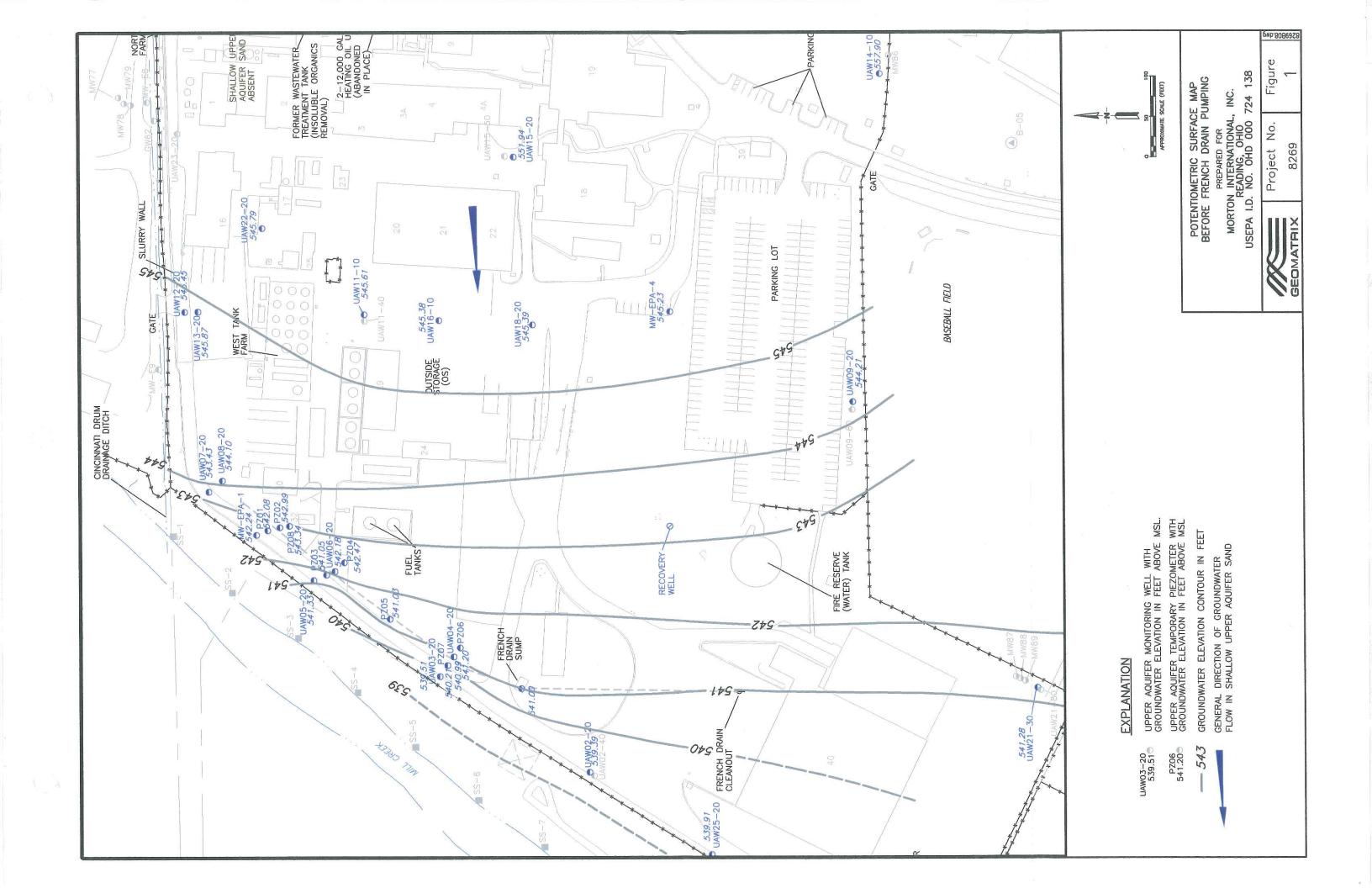
[&]quot;B" - inorganic data - Indicates that result is between the Method Detection Limit and the Reporting Limit.

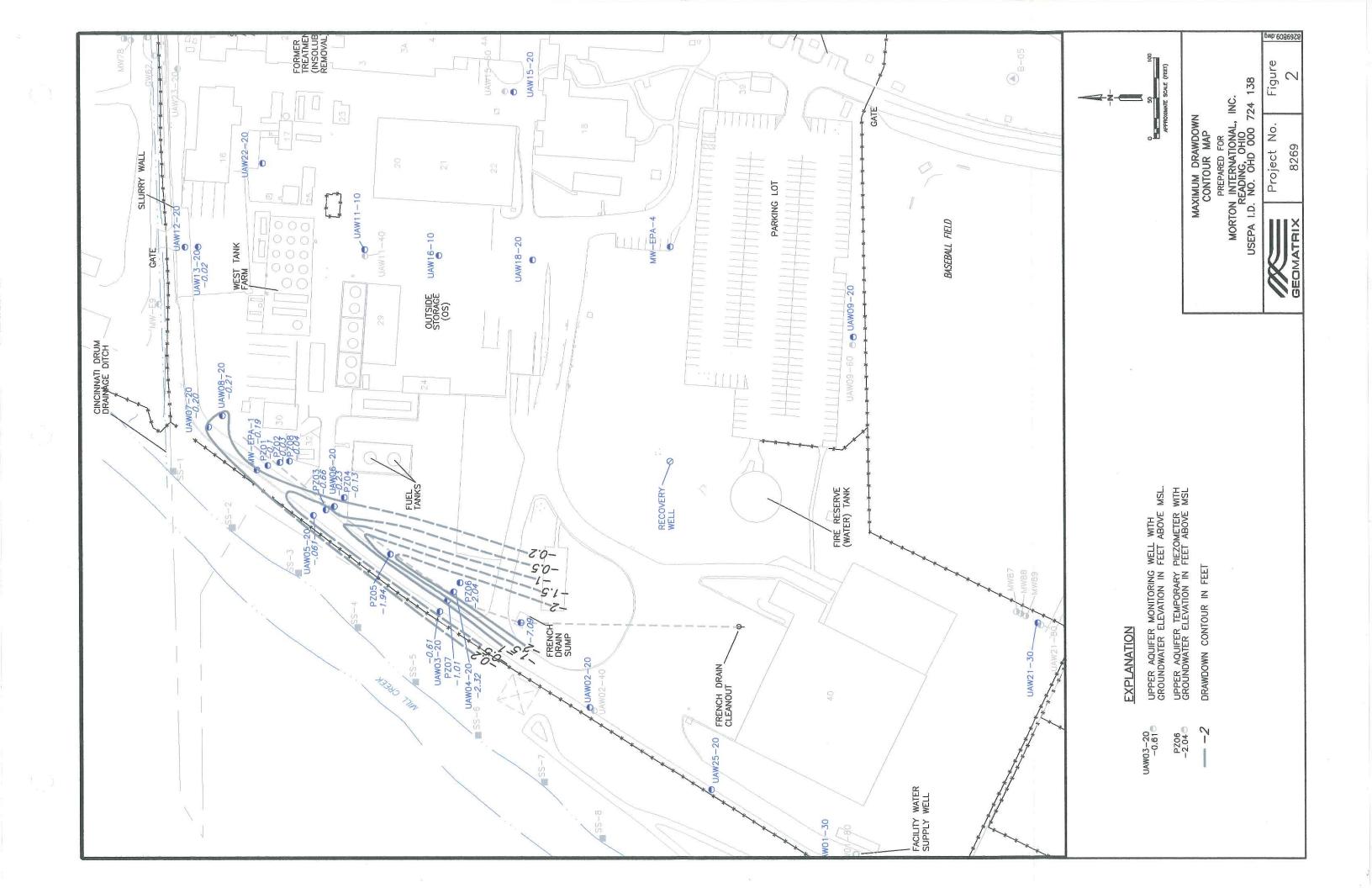
[&]quot;J" - inorganic data - Indicates the associated Method Blank contained concentrations at a detectable level.

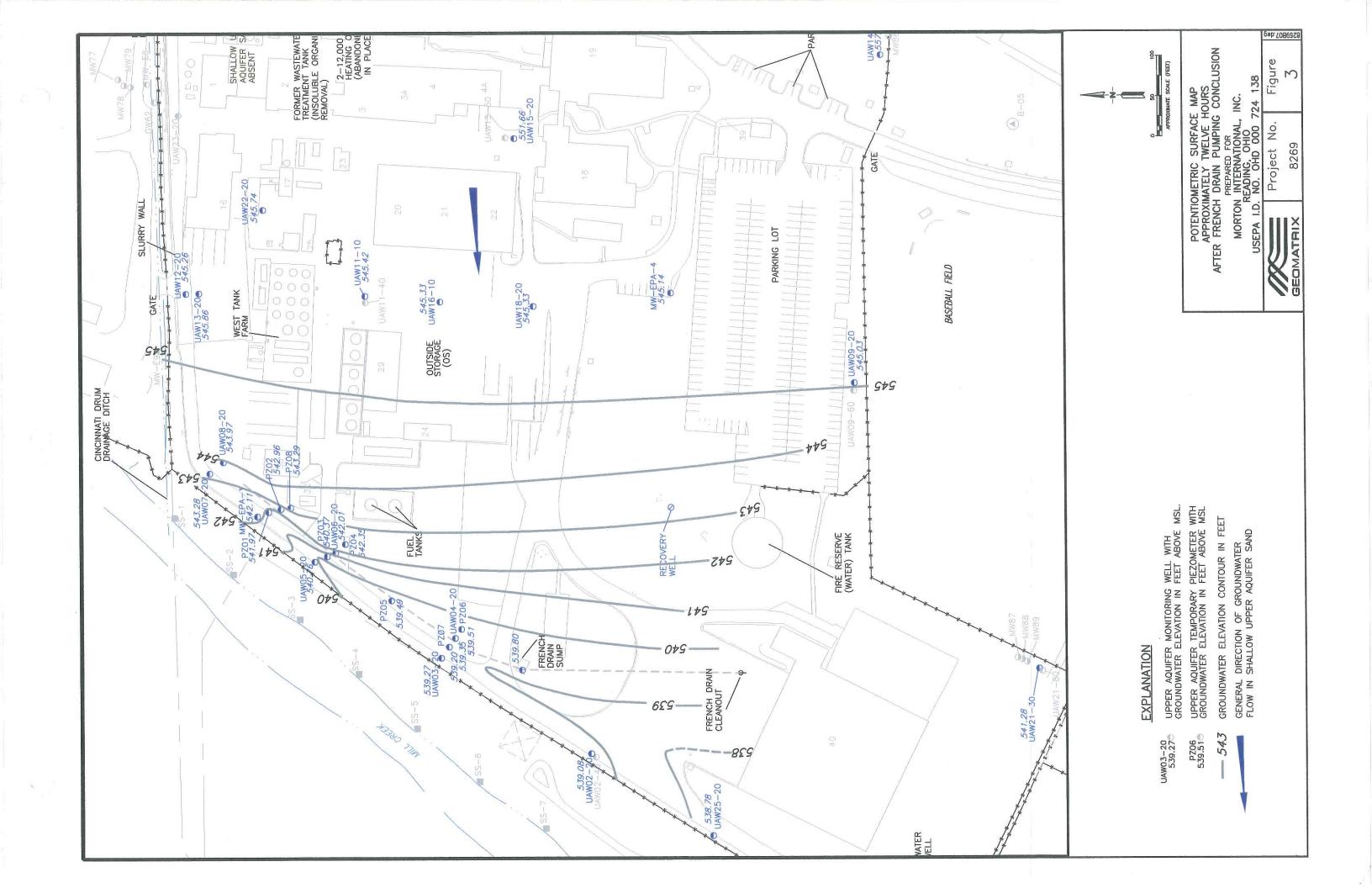
[&]quot;J" - organic data - Indicates that result is between the Method Detection Limit and the Reporting Limit.

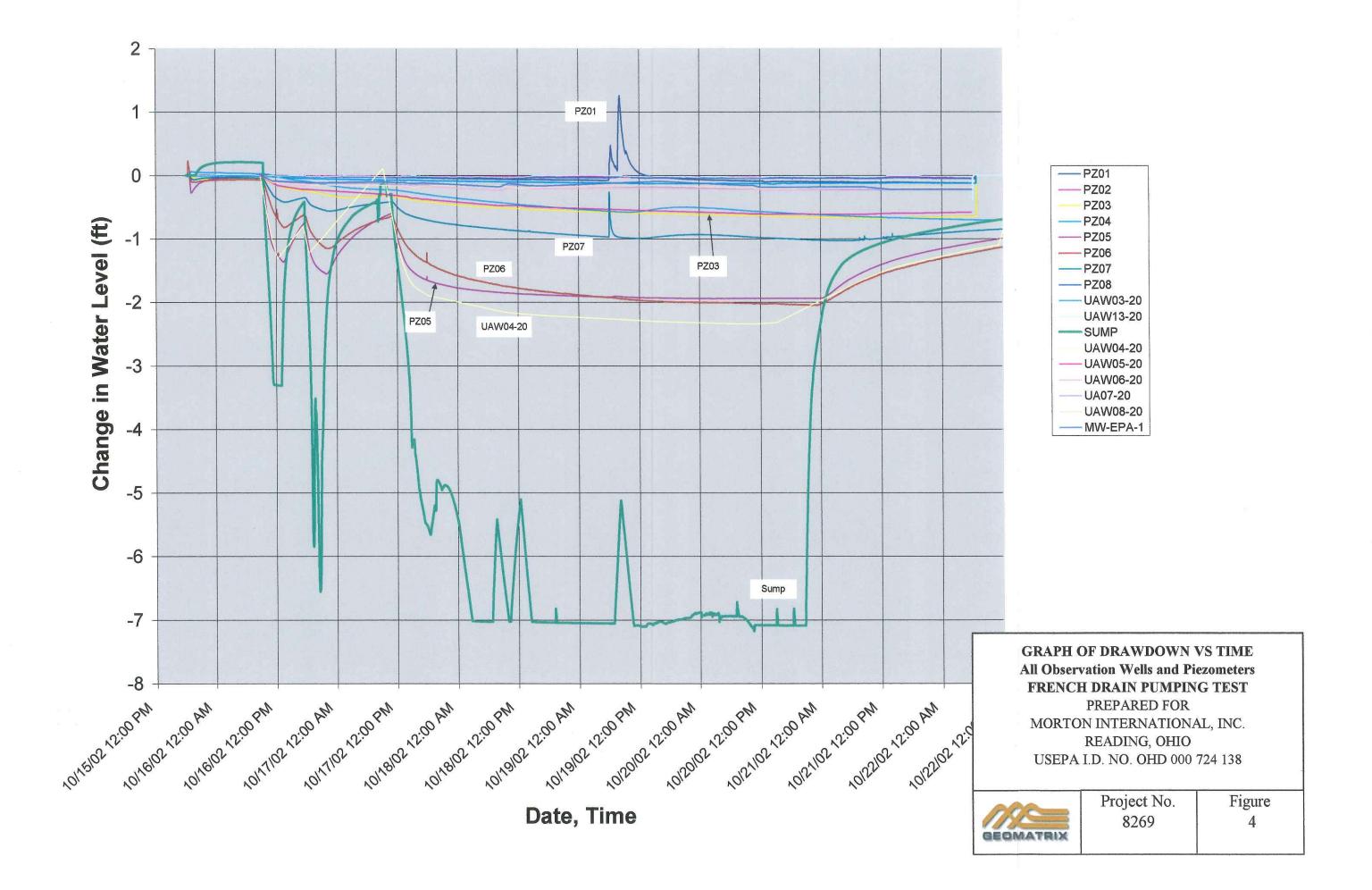
[&]quot;B" - organic data - Indicates the associated Method Blank contained concentrations at a detectable level.

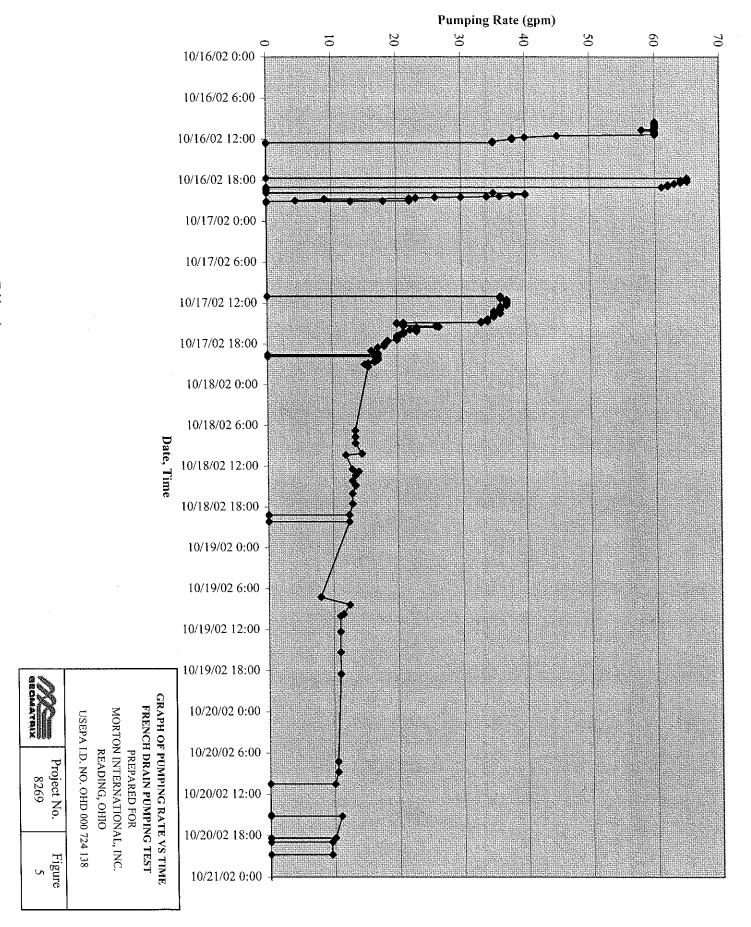
[&]quot;<" chemical not detected at the indicated Reporting Limit.











1 October 2002



Ms. Mirtha Capiro
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division
U.S. Environmental Protection Agency
Region 5 (DE-9F)
77 West Jackson Street
Chicago, Illinois 60604-3590

Re:

Morton International, Inc.

Reading, Ohio Facility

RCRA Docket No. R3013-5-00-001

Via: Overnight Courier Airbill #

This letter is to inform the USEPA Region 5 that a pump test on the existing groundwater recovery system is tentatively scheduled to be conducted the week of October 14, 2002 at the Rohm and Haas-Reading, Ohio facility. For your review, please find enclosed two copies of the *French Drain Pumping Test Work Plan* prepared by Geomatrix Consultants. This document provides the objectives, field activities and procedures for this investigation.

Although the exact schedule for the work has not yet been coordinated with plant operations, we expect to have start and stop dates set by the beginning of next week. We will provide those to you via telephone or email so that you or your representative can be present to observe the test if you so choose.

Thank you for your consideration in this matter. Please call me if you have any questions or concerns.

Sincerely,

Peter V. Palena Jr.

bcc:

Bruce Beiser

Jennifer Berke-Levin

Eric Walker

Mark Hemingway



March 20, 2001

Ms. Mirtha Capiro Project Coordinator U.S. Environmental Protection Agency Region 5 77 W. Jackson Boulevard, DRE-9J Chicago, Illinois 60604-3590

RE: Morton International Inc.,

Reading, Ohio

RCRA Docket No. R3013-5-00-001

Dear Ms. Capiro:

In a recent email to Peter Palena, you requested that we review the pH values from the well sampling and development records. The attached table summarizes the <u>final</u> pH values for each well, at the conclusion of the pre-sampling purging or the initial well development. These final pH values reflect the stable reading obtained in accordance with our Field Operating Procedures. Given this, they should be data that is most representative of aquifer conditions.

Most of the pH values are in the range of 5.5 to 7. This is consistent with normal pH values for natural surface waters or shallow groundwaters, which tend to be slightly acidic. This acidity generally reflects natural acids from organic matter or the dissolution of carbon dioxide.

Note that every well in the table exhibits at least one reading in this normal range. This strongly suggests that the relatively small number of readings below this range probably reflect a fluctuating response from the pH meter, and not actual groundwater pH. Such meters, unfortunately, do tend to be somewhat temperamental under field conditions. We do not believe these lower pH values reflect actual acidic conditions in the subsurface.

To address this issue with field measurements, we will make the following modifications to the field operating procedures and the request for sample analysis:

- In the event that the pH readings for a given well are not within the range of 5.5 to 7.5, the pH meter will be recalibrated and the well will continue to be micro-purged.
- pH calibration solutions will be replaced at the beginning of each sampling event.
- Laboratory measurement of pH in groundwater samples will be added to the request for analysis submitted to Severn Trent Laboratories (STL).

Ms. Mirtha Capiro U.S. Environmental Protection Agency March 20, 2002 Page 2 of 2



Thank you for bringing your concerns to our attention. If you have any questions regarding our evaluation of the pH data or the corrective measures that will be implemented for future sampling, please feel free to contact me.

Sincerely GEOMATRIX CONSULTANTS, INC.

Mark P. Hemingway Principal Hydrogeologist

Mr. Peter V. Palena, The Rohm and Haas Co.

Mr. Todd Quillen, TechLaw Inc.

pH Summary Morton International, Inc. Reading, Ohio



		pН	
	Sample Event 1	Sample Event 2	Sample Event 3
Well ID	(May 2001)	(October 2001)	(November 2001)
MW-EPA-1	6.55	NA	6.96
MW-EPA-3	6.67	NA	6.26
MW-EPA-4	6.44	NA	6.29
UAW01-30	4.94	NA	7.18
UAW01-80	6.25	6.45	5.70
UAW02-20	6.27	NA	6.95
UAW02-40	6.65	NA	7.36
UAW03-20	6.02	NA	7.54
UAW04-20	5.58	NA	7.36
UAW05-20	7.5	6.87	NA
UAW06-20	6.96	6.81	NA
UAW07-20	6.79	NA	6.92
UAW08-20	7.09	NA	NA
UAW09-20	6.60	NA	5.01
UAW09-60	6.58	NA	5.43
UAW10-50	NA	7.18	NA
UAW10-80	NA	7.48	NA
UAW11-10	7.23	NA	7.36
UAW11-40	6.24	NA	5.17
UAW12-20	5.71	NA	6.61
LAW12-60	NA	7.40	7.51
UAW13-20	4.33	NA	6.51
UAW14-10	6.87	NA	5.05
UAW15-20	6.82	NA	7.32
UAW15-50	7.07	NA	7.96
UAW16-10	NA	6.98	6.40
UAW17-40	6.97	NA	5.41
UAW18-20	NA	7.39	7.05
UAW19-80	6.76	NA	5.21
UAW20-60	6.42	NA	6.43
UAW21-80	4.67	NA	7.45
UAW22-20	NA	6.81	NA
UAW23-20	NA	6.89	6.53
UAW24-70	NA	7.03	7.66
UAW25-20	NA	6.71	6.48

NA Data not available, well not sampled this event.



French Drain Pumping Test Work Plan

Morton International, Inc. Facility [EPA ID No. OHD. 000 724 138] Reading, Ohio

Prepared for:

The Rohm and Haas Co. Bristol, Pennsylvania

September 2002

Project No. 8269

French Drain Pumping Test Work Plan

Morton International, Inc. Facility [EPA ID No. OHD. 000 724 138] Reading, Ohio

Prepared for:

The Rohm and Haas Co.

Bristol, Pennsylvania

Prepared by:

Geomatrix Consultants, Inc.

5725 Hwy 290 West, Suite 200B Austin, Texas 78735

September 2002

Project No. 8269

TABLE OF CONTENTS

			Page	
1.0	INTRO	DDUCTION	1	
2.0	SCOPI	E OF WORK	2	
3.0				
4.0	FIELD 4.1 4.2 4.3 4.4 4.5 4.6	ACTIVITIES TEMPORARY PIEZOMETER INSTALLATION HORIZONTAL AND VERTICAL LOCATION WATER LEVEL MEASUREMENTS FRENCH DRAIN SYSTEM PUMPING TEST EXTRACTION WATER SAMPLING EXTRACTION WATER ANALYSIS	7 8 9	
5.0	REFEI	RENCES	14	
		TABLES		
Table :	_	Monitoring Target Analyte List Sample Container Requirements		
		FIGURES		
Figure Figure Figure Figure Figure	2 3 4 5	Site Plan and Groundwater Gradient Map Cross-Section Location Map East-West Cross Section North-South Cross Section Pumping Test Decision Diagram Diagram of Drawdown Terminology		

Morton International, Inc. French Drain Pumping Test Work Plan Revision: 00, September 2002

TABLE OF CONTENTS

(continued)

APPENDICES

Field Operating Procedures Field Forms Appendix A

Appendix B

Appendix C ATEC Construction Drawings

1.0 INTRODUCTION

Morton, a wholly-owned subsidiary of the Rohm and Haas Co. (Rohm and Haas), is the owner and operator of a facility at 2000 West Street, Reading, Ohio. This facility is herein referred to as the Morton Facility or "the facility." In 1985, a French drain system was installed along Mill Creek on the western edge of the facility. The site plan, with the location of the French drain, is shown in Figure 1. The drain system was originally designed and installed to collect contaminated groundwater downgradient of the facility, preventing it from entering Mill Creek. Collected groundwater is treated and then re-used as process water. However, the presence of seeps and related chemical data indicate that some shallow groundwater is discharging to the creek.

Geomatrix Consultants, Inc., (Geomatrix) has prepared this French drain pumping test work plan at the request of Rohm and Haas Co. The objective of the French drain pumping test is to further define the performance characteristics and effectiveness of the French drain. Specifically, the goal of the pumping test is to answer the following questions:

- 1. Is the French drain in its present condition capable of adequately controlling groundwater flow in the Shallow Upper Aquifer (UA) Sand?
- 2. If so, what minimum rate of water removal will be required to achieve an acceptable level of control?
- 3. What is the initial quality of water that will be recovered from the French drain when operated at the sustainable pumping rate determined by this pumping test?

This work plan describes the various activities and methods to be used to generate the data necessary to answer the study questions. The answers to these questions will be used in evaluating whether the French drain can be an effective means of controlling groundwater, and in defining and selecting alternatives for the reuse, treatment, and/or discharge of the recovered groundwater.

Morton International, Inc. Reading, Ohio French Drain Pumping Test Work Plan Revision: 00, September 2002 Page 2 of 14

2.0 SCOPE OF WORK

The scope of this project includes several tasks in addition to the pumping test in order to provide additional and more complete information regarding the effects of the pumping test on the French drain. Following completion of the field activities and laboratory analyses, the resulting data will be evaluated and a report will be prepared presenting the findings and conclusions. The scope of work for the pumping test includes the following activities:

- **Temporary Piezometer Installation** Install approximately six temporary piezometers to improve measurement of hydraulic gradients in the vicinity of the French drain during pumping test.
- Measurement and Testing Perform water level measurements and pumping test on the French drain system to obtain aquifer response (drawdown) to pumping at a specific flow rate, in order to evaluate drain performance.
- Extraction water Sampling Collect and analyze samples of water produced by the French drain to evaluate water quality parameters. Water quality data will be used in evaluating options for use, treatment, and/or disposal of collected extraction water.

3.0 BACKGROUND

The Morton Facility is located at 2000 West Street, Reading, Hamilton County, Ohio. The City of Reading is a northern suburb of Cincinnati, Ohio. The Morton Facility consists of a single tract of land totaling 34 acres. Of these, approximately 27 acres consists of the fenced, operational area of the facility. The remaining 7 acres contain baseball/soccer fields; Morton provides the use of these fields to the City of Reading.

The Morton Facility and its surroundings have been investigated with respect to environmental impact since the late 1970s. Detailed information regarding the history, setting and environmental character of the Morton Facility and its surroundings is provided in the Current Conditions Report (Geomatrix, 2000) and Facility Investigation (FI) Report (Geomatrix, 2002).

The French drain was installed in 1985 by ATEC Environmental Services (ATEC) using a "one-pass" method. According to design drawings prepared by ATEC, the French drain is approximately 440 feet long and runs parallel to the property line along Mill Creek in the northwest portion of the facility. The French drain was designed to be a minimum of 12 inches wide. The total depth of the French drain varies from 13 to 23 feet below ground surface (bgs). The drain includes a flexible six-inch perforated high-density polyethylene (HDPE) pipe installed approximately 2 feet below the top of the clay stratum. The excavation is backfilled with gravel to a depth of four to eight feet below grade. The upper four to eight feet is backfilled with clayey silt material. The French drain terminates at a sump that is constructed of 12 linear feet of 4-foot diameter perforated concrete pipe, topped with 10 linear feet of unperforated concrete pipe. Groundwater from a nearby recovery well is also pumped into the French drain sump. A copy of the ATEC construction drawings are provided in Appendix C attached.

3.1 HYDROGEOLOGY

The shallow transmissive strata at the Morton Facility consist of interbedded sand, gravel, silt, and clay outwash, till, and lacustrine deposits present within a buried valley. The valley is oriented generally north-south, along the course of Mill Creek; its boundaries comprise relatively non-transmissive shale and limestone bedrock. The outwash deposits range from approximately 130 to 160 feet thick, but pinch out to the east and west of the site, at the margins of the buried valley.

Morton International, Inc. Reading, Ohio French Drain Pumping Test Work Plan Revision: 00, September 2002 Page 4 of 14

Parties historically performing investigation and remediation activities in the site vicinity have divided the glacial deposits into two aquifers: the Upper and the Lower. This classification will continue to be utilized. At the site, the two aquifers are believed to be typically separated by a low-permeability till stratum consisting predominantly of clay and silt. The degree of communication between the two aquifers probably varies locally depending primarily on the thickness and character of this till layer.

The UA is divided into as many as three sand layers, separated by layers of clay till. The French drain is completed in the shallowest sand unit of the Upper Aquifer, termed the Shallow UA Sand. Therefore, the hydrogeologic discussion presented in this report is limited to this zone. A more thorough description of the site hydrogeology is presented in the FI Report (Geomatrix, June 2002).

The Shallow UA Sand consists of a single sand bed observed at typical depths of 10 to 20 feet bgs across most of the Morton Facility, excepting only the northeastern corner. In this area, it transitions to thin stringers and lenses of sand, rather than a continuous bed. The lateral extent of this sand on the Morton Facility is shown on Figures 2, 3, and 4. The French drain is constructed through the Shallow UA Sand along the west boundary of the facility.

Depth to groundwater within the Shallow UA Sand is typically 10 to 20 feet bgs, depending on location, and groundwater is present under unconfined (water table) conditions. During three separate water-level measurement events over a two-year period, water levels in the Shallow UA Sand have varied only 1 to 1.5 feet. Water level data have consistently indicated groundwater flow is generally from the east and northeast of the Morton Facility, across the site toward the west-southwest to Mill Creek. Gradients within this sand ranged from 0.017 to 0.03 feet per foot (ft/ft), and step-drawdown testing performed in conjunction with the 2002 field investigation resulted in calculation of an estimated hydraulic conductivity (K) of 106 feet per day (ft/day) (Geomatrix, June 2002). This value is consistent with the observed lithology of this stratum, which is typically fine to medium sands and silty sands. Using this K value, an assumed effective porosity of 25%, and a typical gradient value of 0.019 ft/ft yields a groundwater velocity of 8 ft/day. The Shallow UA Sand appears to be generally isolated hydraulically from both deeper Upper Aquifer Sands and the Lower Aquifer. The saturated thickness of the Shallow UA Sand ranges from approximately one to over four feet in the

vicinity of the French drain. However, the saturated thickness of the Shallow UA Sand increases to over 10 feet in the area of the facility south of the French drain terminus.

The saturated portion of the Shallow UA Sand outcrops in the lower portions of the Mill Creek channel. The presence of seeps and related chemical data discussed in the Fl Report indicate that shallow groundwater within this sand is discharging to the creek. The rate of discharge has not been quantified.

3.2 SURFACE WATER HYDROLOGY

Mill Creek is the only body of surface water in the vicinity of the Morton Facility. Mill Creek is a tributary of the Ohio River, and the confluence of the two streams is located approximately 14 miles, measured along the Mill Creek channel, south of the Morton Facility. Mill Creek currently lies 80 to 100 feet west of the Morton Facility property boundary. Before about 1950, however, aerial photographs indicate that, in the vicinity of the Morton Facility, the creek's course was approximately 300 feet to the west of its current location. The change is believed to be part of drainage and flood control improvements performed by the U.S. Army Corps of Engineers around this time. The reach of Mill Creek adjacent to the plant has been straightened and channelized.

A contributing stream enters Mill Creek from the General Electric property to the northwest of the Morton Facility, and surface drainages also enter Mill Creek from the Cincinnati Drum and Pristine properties, upstream of the Morton Facility. In addition, treated water from the Pristine groundwater recovery and treatment system is discharged to Mill Creek.

Drainage from the Morton Facility does not typically enter Mill Creek. Instead, this drainage enters the facility's sewers, discharging into the combined sewer system operated by the Metropolitan Sewer District (MSD). Facility runoff does periodically enter Mill Creek during major storm/flooding events. Runoff and wastewaters from local facilities may still, on occasion, enter Mill Creek as evidenced by documented past failures in the MSD sewer system (Thiokol, 1981).

Mill Creek is not used for drinking water supply or agricultural watering in Hamilton County (PRC, 1993), and no known surface water intakes are located within three miles of the Morton

Morton International, Inc. Reading, Ohio French Drain Pumping Test Work Plan Revision: 00, September 2002 Page 6 of 14

Facility (TechLaw, 1998). The creek is, however, reported to be occasionally used for recreational purposes (U.S. Army Corps of Engineers, 1990; CDM, 1986).

As previously discussed, the uppermost saturated sand underlying the Morton Facility (the Shallow UA Sand) is in hydraulic communication with Mill Creek, and is discharging groundwater through the banks and bed of the creek. Seeps were visible along the portions of the creek bordering the Morton Facility and Cincinnati Drum. Chemical impact to Mill Creek sediments and seeps near the Morton Facility is discussed in the FI Report.

4.0 FIELD ACTIVITIES

The following sections discuss the field activities to be conducted during this investigation. Field operating procedures for equipment calibration and decontamination, borehole destruction, investigation-derived waste management, and other related operations are included in Appendix A.

Field personnel will document all field activities. Documentation procedures are described in Appendix A. Samples of documentation forms are provided in Appendix B

4.1 TEMPORARY PIEZOMETER INSTALLATION

Approximately six temporary piezometers will be installed at the locations along the French drain alignment. These temporary piezometers will be used to collect water level information during the pumping test. Temporary piezometers will be plugged at the conclusion of the pumping test using the methods described in Appendix A.

The piezometers will be typically installed to the bottom of the Shallow UA Sand. Depth to the bottom of the Shallow UA Sand will be determined at each general location based on soil sampling during the direct push. The piezometers will be installed using direct push technique (DPT) methods. At least one boring will be continuously sampled for each piezometer or cluster of piezometers, unless stratigraphic data from an existing boring already exists for that location. All piezometers will be nominal ¾-inch diameter and will be constructed of new polyvinyl chloride (PVC) riser and screen. All piezometers will be constructed with five-foot screens. Following piezometer completion, bentonite pellets will be used to form a low mound surrounding the exposed riser, in order to prevent infiltration of surface water.

All drilling and sampling equipment will be decontaminated prior to use. Field operating procedures for documentation, equipment decontamination, borehole destruction, investigation-derived waste management, and other related operations are included in Appendix A.

4.2 HORIZONTAL AND VERTICAL LOCATION

The horizontal and vertical location of the temporary piezometers, French drain sump and the water level in Mill Creek will be measured relative to other permanent features previously surveyed (other nearby permanent monitoring wells) using a builder's level and rod.

4.3 WATER LEVEL MEASUREMENTS

Water levels will be measured in the newly installed piezometers and selected permanent wells before the start of the pumping test, and periodically during the pumping and recovery phases of the pumping test. Water levels will be measured using both e-lines and data loggers, depending on location. Water levels will be measured to the nearest 0.01 foot. Data loggers and vented pressure transducers will be placed in selected wells to provide a more detailed plot of drawdown over time, to measure levels overnight, and to help detect any external events which could affect water levels in the aquifer. The remaining wells will be measured manually using e-lines. The frequency of water level measurements is discussed in Section 4.5 below. Transducer pressure ranges should be as small as practical, but large enough to allow for the maximum expected drawdown (1 to 3 feet). All water level measurements and the time of measurement will be recorded on the aquifer test data form (see Appendix B) for the appropriate well or piezometer. Figure 1 shows the location of existing wells to be measured, proposed piezometer locations as well as groundwater elevation contours of the shallow groundwater beneath the site in March 2002. The following existing wells have been selected for measurement during the pumping test ("observation wells"):

- UAW03-20 downgradient¹, south end
- UAW04-20 upgradient, south end
- UAW05-20 downgradient, middle
- UAW06-20 upgradient, middle
- UAW07-20 downgradient, north end
- UAW08-20 crossgradient, north end
- MW EPA-1 downgradient, north end

In addition, water levels will be measured in the following existing wells ("aquifer wells") twice to map the natural water table before the test and at the point of maximum drawdown, just before the pumping is stopped:

• UAW02-20

UAW09-20

Position of the monitoring well is with respect to the French drain.

Morton International, Inc. Reading, Ohio French Drain Pumping Test Work Plan Revision: 00, September 2002 Page 9 of 14

•	UAW11-10	•	UAW12-20
•	UAW13-20	•	UAW14-10
•	UAW15-20	•	UAW16-10
•	UAW18-20	6	UAW22-20
•	UAW23-20	•	UAW25-20
•	MW EPA-2	•	MW EPA-4

The drawdown data collected from the aquifer wells will be used to evaluate French drain capture.

Vented pressure transducers with data loggers will be placed in:

- the sump, to monitor pumping test operations,
- the most upstream French drain cleanout, to monitor water levels in French drain pipe,
- all newly installed piezometers, to monitor water levels adjacent to the French drain, and
- UAW13-20, to monitor background water levels.

Data acquisition for these transducers will be set on an interval of one to five minutes.

4.4 French drain System Pumping Test

The withdrawal rate needed for the French drain to capture all groundwater in the affected part of the Shallow UA Sand has been estimated at approximately 60 gallons per minute (gpm) based on a calculated hydraulic conductivity (K), the measured hydraulic gradient, and the cross sectional area of the Shallow UA Sand upgradient of the French drain. The hydraulic conductivity was estimated based on the results of the step pumping test performed during the F I (Geomatrix, 2002). The actual flow may be more or less, depending on variations in true saturated thickness and hydraulic conductivity, the contribution from Mill Creek, and flow to the southern end of the drain from the thicker portions of the Shallow UA Sand located southeast of the French drain.

Initially, pumping will remove the water stored in the sump and the French drain gravel. As the stored water is removed, continued pumping will begin to remove water from within the aquifer. Based on the predicted flow rate, it is estimated that system storage will no longer influence flow or drawdown after the first four hours of pumping. It is anticipated that the entire pumping test will be completed in 48 hours.

During the pumping test, the recovered extraction water will be stored in frac tanks at the circular laydown area near the French drain sump. As described in Appendix A, the recovered extraction water will subsequently be drained back into the sump, from which it will be pumped, treated, and re-used in the plant operations. The water maybe disposed of at an appropriate off-site facility if the water can not be worked back into the existing plant operations.

If the French drain is pumped at 60 gpm for a period of 48 hours, approximately 173,000 gallons of extraction water will be produced. Storage of this volume of water will require eight 21,000-gallon frac tanks. Because of the potentially large volume of water to be handled, if it is determined during the initial pumping that a pumping rate greater than 60 gpm will be required and therefore significantly more water will be produced, the test will be stopped to either arrange for additional water holding capacity, or reevaluate the test procedure.

Water levels in the sump, piezometers and the observation wells will be measured during the pumping test as described above. Measurement frequency is described below.

The procedures for the French drain pumping test are:

- 1. <u>Initial Preparation</u> Pumping to and from the sump will be ceased for a period of at least 5 days prior to the test to establish static conditions. Flow from recovery well to the sump and flow from the sump to the treatment plant will be shut off and locked/tagged out. The water elevation and depth to French drain invert, or bottom of the sump if invert is not visible, will be measured.
 - Before pumping begins, water level measurements will be taken in the sump and in all facility piezometers and monitoring wells.
- 2. <u>Pumping Phase</u> The pumping rate will initially begin at 60 gpm. If the water level in the sump stabilizes and the drawdown is less than one foot, this flow rate will be insufficient, and the holding capacity (frac tanks) will be too small for the test. In this event, the test will be stopped to arrange for additional water holding capacity or test re-evaluation. Once additional capacity is available, the flow rate will be

Morton International, Inc.
Reading, Ohio
French Drain Pumping Test Work Plan
Revision: 00, September 2002
Page 11 of 14

increased. The goal is to achieve a sustainable flow rate at approximately 80 to 100 percent of the available drawdown (i.e., the saturated thickness of the Shallow UA sand in the vicinity of the sump). The flow rate will be adjusted using valving in the discharge pipe.

The water level in the sump will be measured every 10 minutes until a sustainable flow rate/ water level has been achieved. Figure 5 illustrates the process of establishing the final flow rate. Figure 6 shows the available drawdown dimension as it applies to the drain sump. Once a sustainable flow rate is achieved, the water levels in the sump will be measured every 30 to 60 minutes for the duration of the pumping phase. During the pumping phase, water levels in those piezometers and monitoring wells monitored by e-line will be measured every hour. Data loggers installed in wells and piezometers will be set to measure at one to five minute intervals.

If the water level in the sump falls below the level of the invert of the French drain pipe, the flow rate will be reduced to obtain a sustainable water level. All flow rates and flow rate changes will be recorded in the Aquifer Test Log (see Appendix B), along with the pumping start time and the times of all flow rate changes.

During the pumping phase, time-drawdown data for the piezometers and observation wells should be examined to evaluate the progress of the test. If the data indicate sustained steady-state conditions in the aquifer, pumping may be terminated before the planned conclusion, with Project Manager approval. Likewise, the pumping phase of the test may be extended at the discretion of the Project Manager, subject to available tank capacity.

Discharge from the sump will be measured using a flow meter. The accuracy of the flow meter will be checked periodically. The accuracy of the flow meter may be verified by comparing the flow rate obtained by timing a revolution of the sweep needle on the flow meter, with the flow rate obtained by timing the filling of a container of known volume, including a depth interval in a frac tank. Discharge will be maintained at a relatively constant rate. The discharge rate will be checked and adjusted, if necessary, at 10-minute intervals during the first hour of pumping, and at appropriate intervals thereafter. Rate of discharge, cumulative gallons discharged, and time of measurement will be recorded during each check of the flow rate.

3. Recovery Phase - At completion of the pumping phase of the test, the pump will be shut off. Before turning off the pump, water levels will be measured in all observation wells, piezometers, the sump, and the aquifer wells. Care will be taken to ensure that produced water does not flow back into the sump after shut down. During the recovery phase, water level measurements will be taken in the sump,

piezometers, and observation wells every 30 to 60 minutes for a period of 4 hours. Data loggers will be left in their respective wells for an additional 24 hours.

4.5 EXTRACTION WATER SAMPLING

Extraction water will be sampled at the French drain sump after pumping 24 hours, 36 hours, and at the end of the pumping phase. Results of the analyses of this extraction water will be used to help develop cost options for ultimate use, treatment, and/or disposal of the extraction water during operation of the French drain.

The extraction water sample will be collected directly from a sampling port on the pump test discharge piping. Field indicator parameters will be measured prior to sampling, as described in Section 4.6. Sampling data will be recorded on a Well Sampling Record Form (Appendix B). QA/QC samples will consist of one duplicate sample for the final extraction water sample submitted for analysis, and a temperature blank placed into each cooler shipped. Sampling equipment that is not disposable or dedicated to the well will be decontaminated in accordance with the Geomatrix Field Operating Procedures (Appendix A). The samples will be labeled, stored and shipped in accordance with the Geomatrix Field Operating Procedures for Sample Labeling, Storage, and Shipment.

Extraction water samples will be collected in an order based on volatilization sensitivity. The preferred order of sampling is:

- Volatile organics
- Extractable organics (semivolatile organics)
- Inorganics

4.6 EXTRACTION WATER ANALYSIS

Extraction water will be analyzed for the constituents listed in the Monitoring Target Analyte List (Monitoring TAL) in Table 1. The Monitoring TAL was developed based on the results 2001 Field Investigation, as discussed in correspondence to the USEPA dated June 29, 2001. The Monitoring TAL is comprised of all compounds observed in shallow Upper Aquifer

Morton International, Inc. Reading, Ohio French Drain Pumping Test Work Plan Revision: 00, September 2002 Page 13 of 14

groundwater at the Morton Facility, in addition to their potential degradation products. Compounds included VOCs, SVOCs, pesticides, and metals and other inorganic parameters.

In addition to being analyzed for the Monitoring TAL compounds, the extraction water sample will be analyzed for Alkalinity (bicarbonate/carbonate). Chemical analyses of the extraction water sample will be performed at an EPA approved analytical laboratory using the analytical techniques identified in Table 2.

Each extraction water sample will be measured for the field parameters; dissolved oxygen, temperature, pH, and specific conductance. In addition, the extraction water in the sump will be measured periodically for the same field parameters.

5.0 REFERENCES

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TABLE 1 MONITORING TARGET ANALYTE LIST

Morton Facility Reading, Ohio

Volatile Organic Constituent	S	Semivolatile Organic (Constituents
1,1-Dichloroethane	8260B	1,2-Dichlorobenzene	8270C
1,2-Dichloroethane	8260B	1,4-Dichlorobenzene	8270C
Acetone	8260B	2-Methylphenol	8270C
Benzene	8260B	4-Methylphenol	8270C
Bromodichloromethane	8260B	Aniline	8270C
Carbon disulfide	8260B	Benzaldehyde	8270C
Chlorobenzene	8260B	Inorganics	
Chloroform	8260B	Aluminum	6010B
Chloroethane	8260B	Antimony	6010B
Dichlorodifluoromethane	8260B	Arsenic	6010B
Ethylbenzene	8260B	Barium	6010B
Methylcyclohexane	8260B	Beryllium	6010B
Methylene chloride	8260B	Cadmium	6010B
Toluene	8260B	Calcium	6010B
Xylenes (total)	8260B	Chromium	6010B
Organochlorine Pesticides		Cobalt	6010B
Aldrin	8081A	Copper	6010B
alpha-Chlordane	8081A	Cyanide, Total	9012A
alpha-BHC	8081A	Iron	6010B
beta-BHC	8081A	Lead	6010B
delta-BHC	8081A	Magnesium	6010B
4,4'-DDD	8081A	Manganese	6010B
4,4'-DDE	8081A	Mercury	7471 / 7470A
4,4'-DDT	8081A	Nickel	6010B
Dieldrin	8081A	Potassium	6010B
Endosulfan I	8081A	Selenium	6010B
Endosulfan II	8081A	Sodium	6010B
Endrin	8081A	Sulfide	6010B
Endrin aldehyde	8081A	Thallium	6010B
Endrin ketone	8081A	Tin	6010B
Heptachlor	8081A	Vanadium	6010B
Heptachlor epoxide	8081A	Zinc	6010B
Isodrin	8081A		

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Reading, Ohio French Drain Pumping Test Work Plan Revision: 00, September 2002

Page 1 of 1

SAMPLE CONTAINER REQUIREMENTS TABLE 2

Morton Facility Reading, Ohio

Parameter	Matrix	Method	Protocol	Sam	Sample Containers	ıers	Preservation	Holding
				Type	Required Volume	Quantity		Time
, 200	water	8260B	SW-846	viaI	40 m]	2 - 4	HCl to pH<2, Cool to 4 °C, Zero Headspace	14 days from Sample Date
SVOC ²	water	8270C	SW-846	amber glass	1 liter	-	Cool to 4 °C	7 days from sampling to prep/ 40 days after prep to analysis.
Pesticides 3	water	8081A	SW-846	amber glass	1 liter	yang	Cool to 4 °C	7 days from sampling to prep/ 40 days after prep to analysis.
Metals ⁴	water	6010B	SW-846	plastic	4 oz.	.	HNO ₃ to pH<2	6 months from Sample Date
Cyanide	water	9012A	SW-846	plastic	4 oz.	-	NaOH to pH>12, Cool to 4 °C	14 days from Sample Datc
Mercury	water	7470A	SW-846	plastic	4 oz.	_	HNO ₃ to pH<2, Cool to 4 °C	28 days from Sample Date
Alkalinity ⁵	water	310.1	40 CFR 136	plastic	4 oz.	-	Cool to 4 °C, Zero Headspace	14 days from Sample Date

Notes:

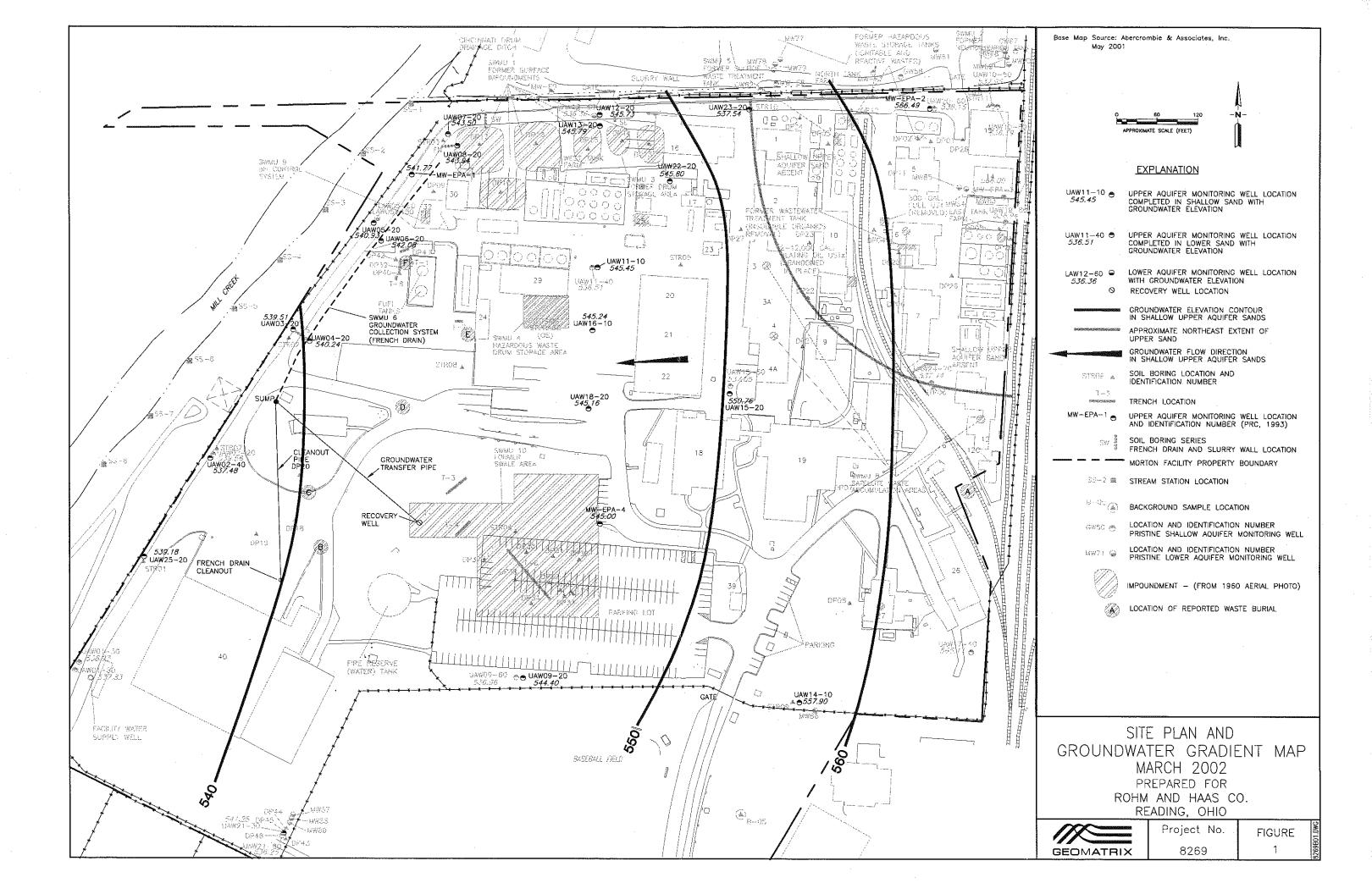
 $VOC = Volatile\ Organic\ Compounds\ as\ listed\ in\ Table\ I.$

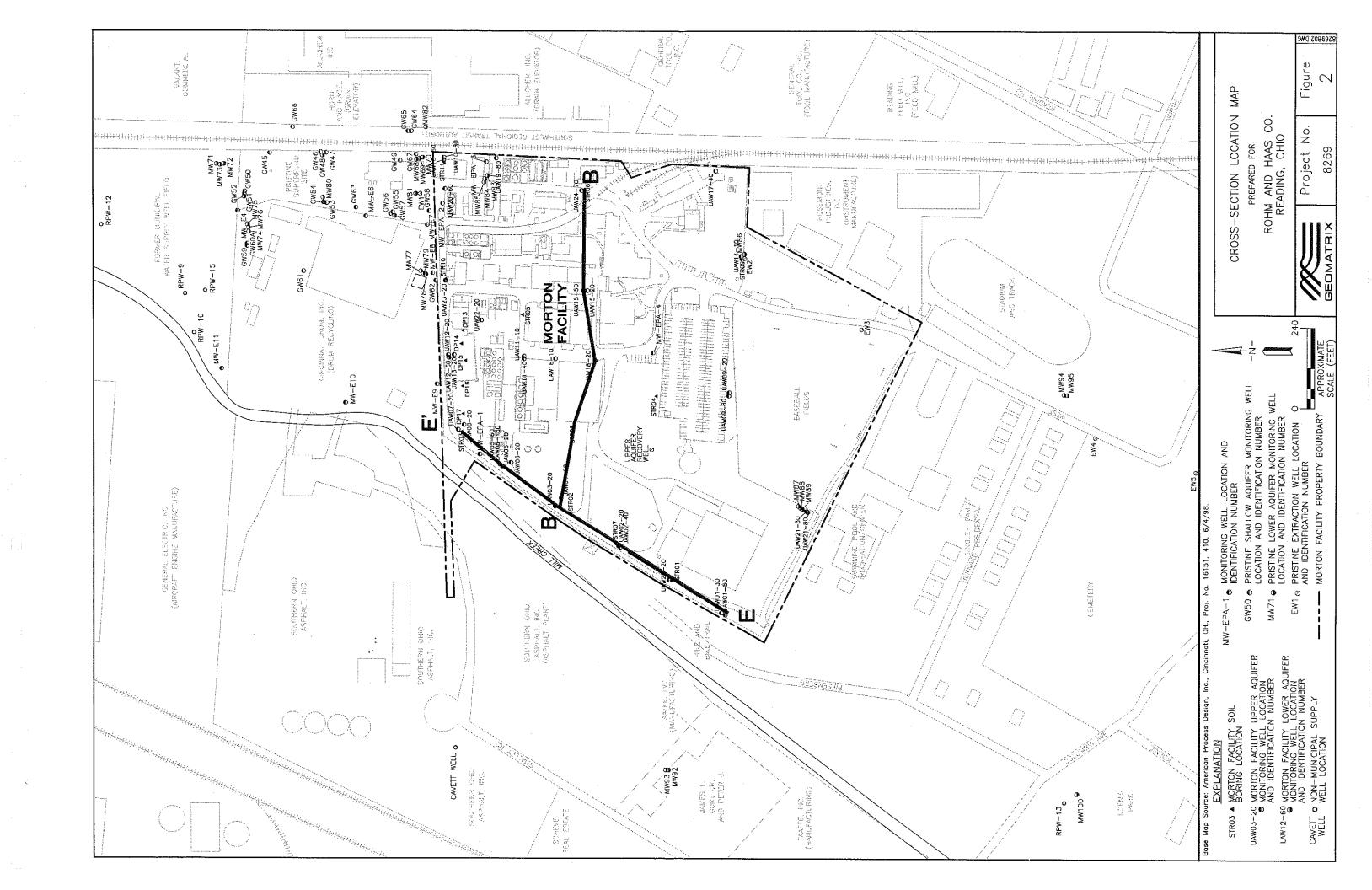
² SVOC = Semivolatile Organic Compounds as listed in Table 1.

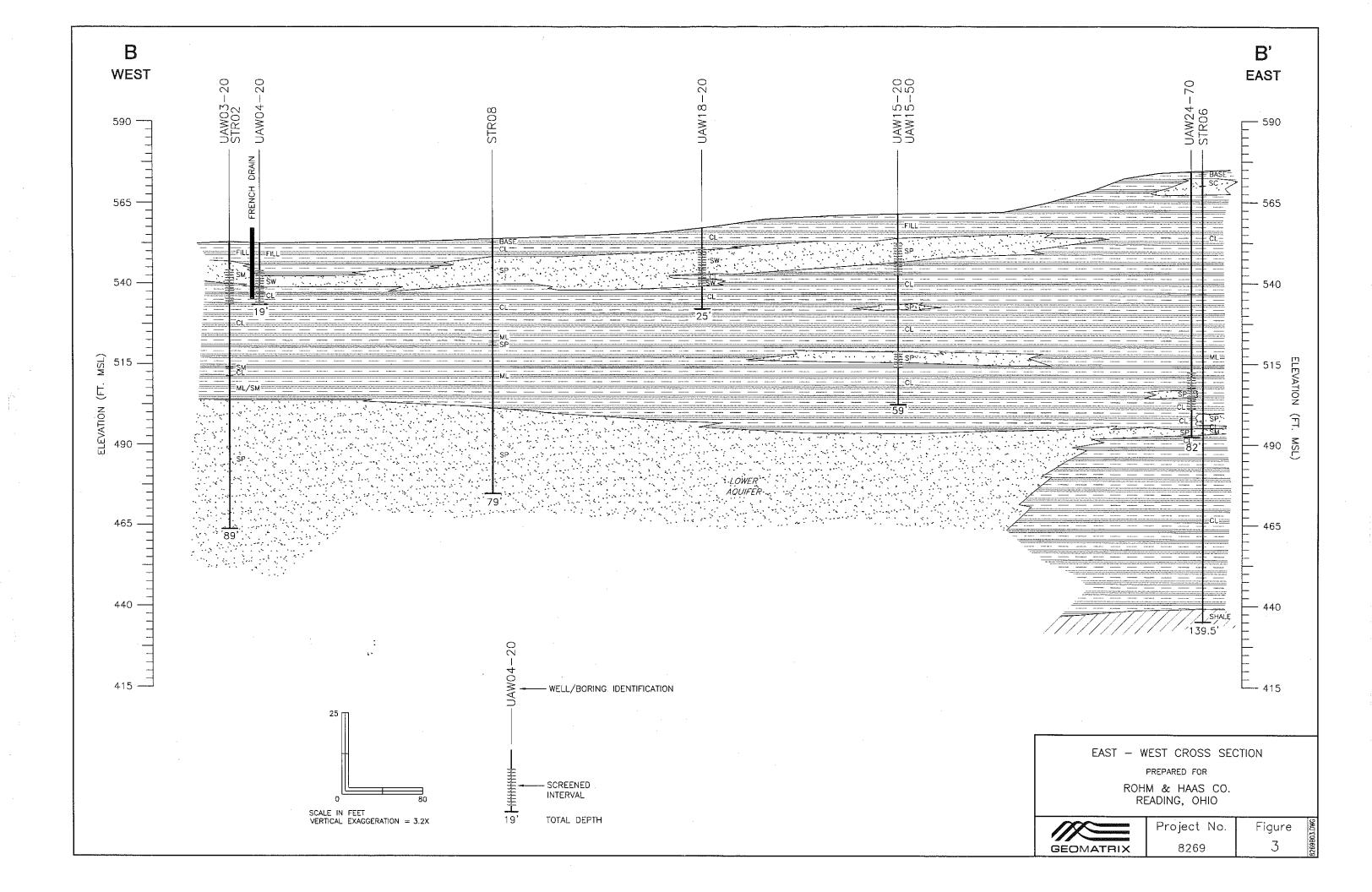
³ Pesticides = Pesticides as listed in Table 1.

⁴ Metals = Inorganics analyzed by Method 6010B, as listed in Table 1.

⁵ Alkalinity = Total Alkalinity, Carbonate, and Bi-Carbonate, 40 CFR Part 136 310.1.







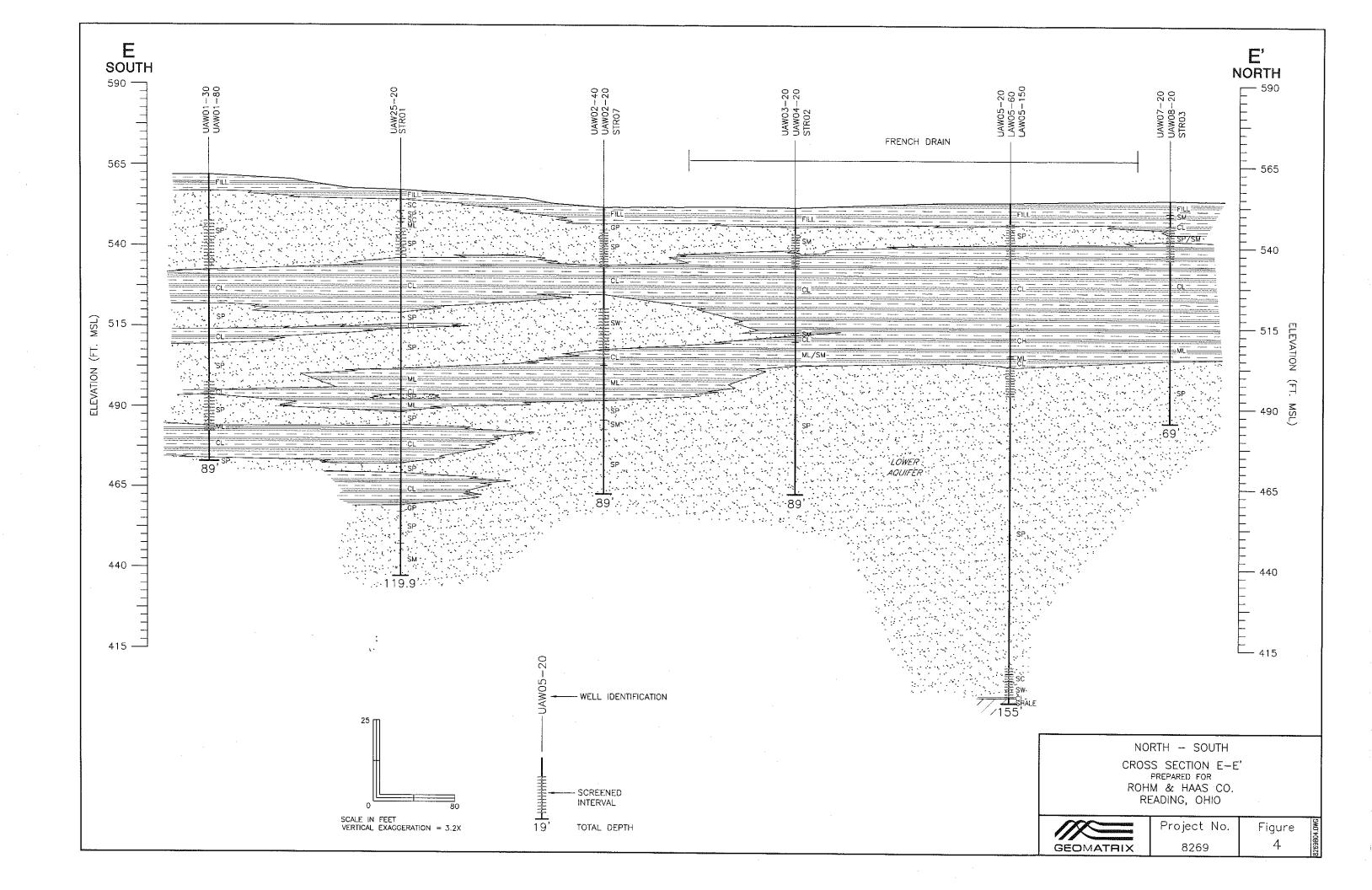


FIGURE 5 PUMPING TEST DECISION DIAGRAM Morton Facility Reading, Ohio

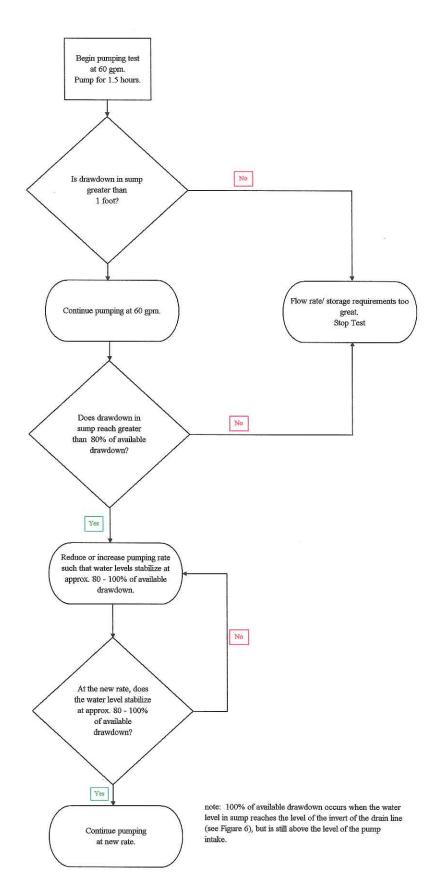
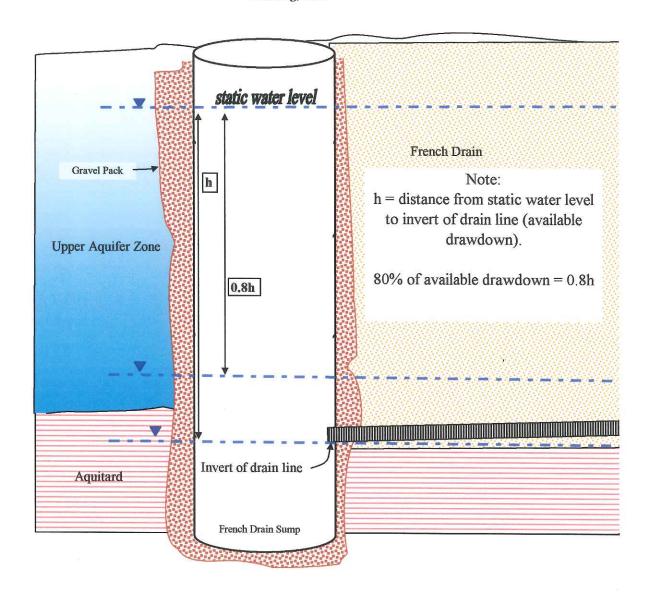


FIGURE 6
DIAGRAM OF DRAWDOWN TERMINOLOGY
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Morton Facility Reading, OH



APPENDIX A

Field Operating Procedures

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DIRECT PUSH TECHNIQUE PROCEDURES

PURPOSE

This guideline presents a method for advancing a borehole, while sampling soils, through unconsolidated materials, including soils or overburden.

PROCEDURE

The following procedure will be used to advance a borehole for sampling and/or well installation, using direct push methods and equipment.

- 1) Mobilize the direct push rig to the site and position over the borehole.
- 2) Level and stabilize the rig using the rig jacks, and recheck the rig location against the planned boring location. If necessary, raise the jacks and adjust the rig position.
- 3) Advance the direct push sampling tool into the subsurface. The direct push tool may be configured to sample continuously as the tool advances. If continuous sampling is to be performed, the Geomatrix field supervisor will verify this configuration with the operator, to ensure sampling is performed through the targeted intervals.
- 4) Check the drive string periodically during drilling to ensure the boring is plumb. Adjust rig position as necessary to maintain plumb.
- 5) Collect soil samples by withdrawing the retrievable sample tool from the drive string and the intervals dictated by the equipment's sample length capacity. The Geomatrix field supervisor will verify the appropriate intervals with the operator.
- 6) Continue advancing the drive string until reaching the total depth assigned by Geomatrix.
- 7) Manage all unused sample/core and other solids as described in the Geomatrix Field Operating Procedure for Management of Investigation-Derived Waste.
- 8) All boreholes not used for well installation will be promptly sealed as described in the Geomatrix Field Operating Procedure for Sealing of Boreholes. In the case of direct push borings, grout will be emplaced either through the drive string as that string is withdrawn, or through a grouting string or tremie driven or pushed into the boring after the drive/sampling string is removed. The grouting string or tremie will be driven or pushed to within five feet of the boring's total depth prior to grouting.

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Other Procedural Issues:

- Borings will not be advanced past the assigned total depth (rat holed) without the express permission of the Geomatrix field supervisor.
- All depth measurements should be accurate to the nearest 0.1 foot, to the extent practicable.

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GROUNDWATER LEVEL MEASUREMENT

PURPOSE

This procedure describes the methods used to obtain accurate and consistent water level measurements in monitoring wells. Water levels will be measured at monitoring wells and, if practicable, in supply wells to estimate purge volumes associated with sampling, and to develop a potentiometric surface of the groundwater in order to estimate the direction and velocity of flow in the aquifer. Water levels will be measured using an electronic water level indicator (e-line) that has been checked for operation prior to mobilization.

PROCEDURE

- 1) Decontaminate the e-line probe and a lower portion of cable following the procedures referenced in the Geomatrix Field Operating Procedure for Sampling Equipment Decontamination. Store the e-line in a protected area until use. This may include wrapping the e-line in clean plastic until the time of use.
- 2) Unlock and remove the well protective cap or cover and place on clean plastic.
- 3) Lower the probe slowly into the monitoring well until the audible alarm sounds. This indicates the depth to water has been reached.
- 4) Move the cable up and down slowly to identify the depth at which the alarm just begins to sound. Measure this depth against the mark on the riser used as a surveyed reference point.
- 5) Read depth from the graduated cable to the nearest 0.01 foot. Do not use inches. If the e-line is not graduated, use a rule or tape measure graduated in 0.01-foot increments to measure from the nearest reference mark on the e-line cable.
- 6) Record the water level on the attached Water Level Monitoring Record.
- 7) Remove the probe from the well slowly, drying the cable and probe with a clean paper wipe. Be sure to repeat decontamination before use in another well.
- 8) Replace well plug and protective cap or cover. Lock in place as appropriate.

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SEALING OF DIRECT PUSH BOREHOLES

PURPOSE

This guideline presets a method for sealing boreholes advanced using direct-push technique (DPT). Boreholes are plugged once their purpose has been served to prevent migration of contaminates or undesirable waters through the borehole.

PROCEDURE

- 1) If a temporary monitoring points or "mini-well" has been constructed within the DPT boring, the sealing operation will begin with the removal of the well casing. If there is no well or monitoring point, the sealing operation will begin with the removal of the DPT drive string.
- 2) After the casing or drive string is removed, a sounding tape will be used to measure the degree to which the boring has remained open.
- 3) If less than 5 percent of the boring, or three feet (whichever is greater) has collapsed, and the boring is dry, the boring may be sealed by surface pouring bentonite chips or granular bentonite into the borehole. This material should be hydrated with potable water at intervals of approximately 5 feet. Powdered bentonite may not be used.

Note: The allowable collapse described in this Step is dependent upon site specific hydrogeology. The borehole should be sealed in a manner that does not allow unacceptable communication between hydraulically isolated strata. If there is uncertainty regarding the appropriateness of a seal interval, field personnel should confirm their plans with the Field Team Leader or Project Manager.

4) If collapse is excessive, or there is greater than two feet of standing water in the borehole, the borehole will be reentered with the drive string or a grouting string. This will be driven to at least 95 percent or three feet (whichever is greater), subject to the qualifications described in Step 3. A high solids bentonite, bentonite cement, or comparable grout will be placed into the borehole through this string.

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- 5) For either sealing method, field staff will calculate the borehole volume and compare it to the final installed volume of solid bentonite or grout to evaluate whether bridging has occurred. These calculations and the actual volume placed will be noted on the Boring Log.
- 6) Where DPT borings are advanced through concrete or asphalt, the paved surface will be restored.

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NON-DISPOSABLE AND NON-DEDICATED SAMPLING EQUIPMENT DECONTAMINATION

PURPOSE

This procedure is to be used for the decontamination of non-disposable and non-dedicated equipment used in the collection of environmental samples. The purpose of this procedure is to remove chemical constituents from previous samples from the sampling equipment. This prevents these constituents from being transferred to later samples, or being transported out of controlled areas.

PROCEDURES

Bailers, split-spoons, steel or brass split-spoon liners, Shelby tubes, submersible pumps, soil sampling knives, and similar equipment will be decontaminated as described below.

- 1) Wash equipment thoroughly with non-phosphate detergent and potable-quality water, using a brush where possible to remove any particulate matter or surface film. If the sampler is visibly coated with tars or other phase-separated hydrocarbons, pre-wash with acetone or isopropanol, or by steam cleaning.
- 2) Rinse with potable water
- 3) Rinse with distilled water
- 4) Air dry; and
- 5) Store in a clean area or wrap in aluminum foil (shiny side out) or new plastic sheeting as necessary to ensure cleanliness.

Submersible pump discharge tubing and associated sample valves or flow-through cells used in well purging or pumping tests will be decontaminated as described below:

- 1) Pump a mixture of potable water and a non-phosphate detergent through the tubing, sample valves and flow cells, using the submersible pump.
- 2) Steam clean or detergent wash the exterior of the tubing, sample valves, flow cells and pump.

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- 3) Pump potable water through the tubing, sample valve, and flow cell until no indications of detergent (e.g. foaming) are observed.
- 4) Double rinse the exterior of the tubing with potable water.
- 5) Rinse the exterior of the tubing with distilled water.
- 6) Store in a clean area or wrap the pump and tubing assembly in new plastic sheeting as necessary to ensure cleanliness until ready for use

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DRILLING AND EXCAVATION EQUIPMENT DECONTAMINATION

PURPOSE

This procedure is to be used for the decontamination of drilling and excavation equipment (i.e., drill rigs, backhoes, augers, drill bits, drill rods, buckets, and associated equipment) used during a subsurface investigation. The purpose of this procedure is to remove chemical constituents associated with a particular drilling or excavation location from this equipment. This prevents these constituents from being transferred between drilling or excavation locations, or being transported out of controlled areas.

PROCEDURE

The following procedure will be utilized prior to the use of drilling or excavation equipment at each location, and prior to the demobilization of such equipment from the site:

- 1) Remove all loose soil and other particulate materials from the equipment at the survey site.
- 2) Wrap augers, tools, plywood, and other reusable items with a plastic cover prior to transport from the site of use to the decontamination facility.
- 3) Transport equipment to the decontamination facility. All equipment must be decontaminated at an established decontamination facility. This facility will be placed within a controlled area, and will be equipped with necessary features to contain and collect wash water and entrained materials.
- 4) Wash equipment thoroughly with pressurized low-volume water or steam, supplied by a pressure washer or steam cleaner.
- 5) If necessary, use a brush or scraper to remove visible soils adhering to the equipment, and a non-phosphate detergent to remove any oils, grease, and/or hydraulic fluids adhering to the equipment. Continue pressure washing until all visible contaminants are removed.

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MANAGEMENT OF INVESTIGATION-DERIVED WASTE

PURPOSE

The purpose of these guidelines is to ensure the proper holding, storage, transportation, and disposal of materials that may contain hazardous wastes. Investigation-derived wastes (IDW) include the following:

- Drill cuttings, discarded soil samples, drilling mud solids, and used sample containers.
- Well development and purge waters and discarded groundwater samples.
- Decontamination waters and associated solids.
- Soiled disposable personal protective equipment (PPE).
- Used disposable sampling equipment.
- Used plastic sheeting and aluminum foil.
- Other equipment or materials that either contain or have been in contact with potentially-impacted environmental media.

Because these materials may contain regulated chemical constituents, they must be managed as a solid waste. This management may be terminated if characterization analytical results indicate the absence of these constituents.

PROCEDURE

- 1) Contain all investigation-derived wastes in Department of Transportation (DOT)-approved 55-gallon drums, roll-off boxes, or other containers suitable for the wastes.
- 2) Contain wastes from separate borings or wells in separate containers (i.e. do not combine wastes from several borings/wells in a single container, unless it is a container used specifically for transfer purposes, or unless specific permission to do so has been provided by the Geomatrix Field Team Leader. Unused soil from surface sample locations within a given area may be combined.

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- 3) To the extent practicable, separate solids from drilling muds, decontamination waters, and similar liquids. Place solids within separate containers.
- 4) Transfer all waste containers to a staging area. Access to this area will be controlled. Waste containers must be transferred to the staging area as soon as practicable after the generating activity is complete.
- 5) Pending transfer, all containers will be covered and secured when not immediately attended.
- 6) Label all containers with regard to contents, origin, date of generation, using the label attached to these Field Operating Procedures. Use indelible ink for all labeling.
- 7) Collect samples for waste characterization purposes, or use boring/well sample analytical data for characterization.
- 8) For wastes determined to be hazardous in character, be aware of accumulation time limitations. Coordinate the disposal of these wastes with the Morton Plant Manager.
- 9) Dispose of investigation-derived wastes as follows:
 - Soil, water, and other environmental media for which analysis does not detect
 organic constituents, and for which inorganic constituents are at levels consistent
 with background, may be spread on Morton Property or otherwise treated as a
 non-waste material.
 - Soils, water, and other environmental media in which organic compounds are detected or metals are present above background will be disposed as industrial waste. Alternate disposition must be consistent with applicable State and Federal laws.
 - Personal protective equipment, disposable bailers, and similar equipment may be disposed as municipal waste, unless waste characterization results mandate disposal as industrial wastes.
 - Groundwater generated from pumping tests will be stored on site pending treatment at Morton's wastewater treatment facility, where it will be treated with other recovered groundwater.

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DOCUMENTATION OF FIELD ACTIVITIES

PURPOSE

Field personnel will maintain a record of decisions, activities, changes, and other significant and pertinent data during the course of field activities. This documentation provides the primary record of the field activities observed, overseen, or performed by those personnel.

PROCEDURE

Field Documents

Personnel assigned by the Geomatrix Field Team Leader or Project Manager will maintain either a Project Field Book or Field Activity Daily Logs (FADLs) for all site activities. Documentation will be started upon initiation of any site activities to document the field investigation process. The Field Books will meet the following criteria:

- Permanently bound, with nominal 8.5-inch by 11-inch gridded pages.
- Water resistant paper.
- Pages must be pre-numbered or numbered in the field, front and back.

FADLS will consist of standardized Geomatrix forms by that name, or pre-printed forms modified for project specific needs.

Notations in the field documents will be in made black or blue ink that will not smear when wet. Information that may be recorded in the field documents includes:

- Time and date of all entries.
- Name and location of project site, and project job number.
- Listing of key project, client and agency personnel and telephone numbers.
- Date and time of daily arrivals and departures, name of person keeping the log, names and affiliation of persons on site, purpose of visit (if applicable), weather conditions, outline of project activities to be completed.
- Details of any variations to the procedures/protocols presented in the Work Plan or Field Operating Procedures, and the basis for the change.

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- Field-generated data relating to implementation of the field program, including sample locations, sample descriptions, field measurements, instrument calibration, etc.
- Record of all photographs taken in the field, including date, time, photographer, site location and orientation, sequential number of photograph, and roll number.
- All fields on the pre-printed field documents will be completed. Fields that are not applicable to a project will be completed with "NA".

Upon completion of the site activities, the field documents will be placed in the project files.

Well Construction Boring Logs

One well construction or boring log will be completed for every boring by the Geomatrix field person overseeing the drilling. At a minimum, these forms will include:

- Project name, location, and number.
- Boring/temporary piezometer number.
- Drilling method.
- Drilling dates.
- Boring depth, diameter.
- Drilling rate, rig chatter, and other drilling-related information.
- Dimensions and depths of the various well components. These include the screened interval, bottom caps or plugs, and the tops and bottoms of the various annular materials.
- Drilling rate, rig chatter, and other drilling related information.

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Daily Drilling Record

The well log form should be used to summarize all drilling activities. One form should be completed for each rig for each day. The form should be signed daily by both the Geomatrix field supervisor and the driller's representative, and provided to the Geomatrix Field Team Leader. These forms will include summaries of:

- Footage drilled, broken down by diameter (e.g. 200 feet of 6-inch diameter hole, 50 feet of 10-inch diameter hole).
- Footage of well and screen installed, broken down by diameter.
- Quantities of materials used, including sand, cement, bentonite, centralizers, protective casings, traffic covers, etc. recorded by well or boring location.
- Active time (hours), and activity (drilling, decontamination, development, well installation, surface completions, etc.)
- Down-time (hours) and reason.
- Mobilizations and other events.
- Other quantities that will be the basis for drilling invoices.

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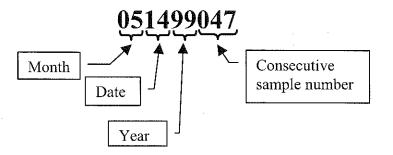
SAMPLE LABELING, STORAGE, AND SHIPMENT

PURPOSE

The collection and analysis of samples of environmental media, including soils, groundwater, surface water, and sediment, are the central activities of the field investigation. These samples must be properly labeled to preserve its identity, and properly stored and shipped in a manner that preserves its integrity and chain of custody. This procedure presents methods for these activities.

SAMPLE LABELING PROCEDURE

1) Assign each sample retained for analysis a unique 9-digit identification code. This code will be formatted as follows



- 2) Consecutive sample numbers will indicate the individual sample's sequence in the total set of samples collected during the investigation. The sample number above, for example, would indicate the 47th sample retained for analysis during the field investigation, collected on May 14, 1999.
- 3) Affix a non-removable (when wet) label to each sample container. The following information will be written on the label with black or blue ink that will not smear when wet:
 - Project number
 - Sample ID (see Step 1 above)
 - Date of sample collection
 - Time of sample collection (military time only)

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- Specify "grab" or "composite" sample with an "X"
- Sampler initials
- Preservative(s) (if applicable)
- Analytes for analysis (if practicable)
- 4) Record all sample label information in the Project field document, keyed to the sample identification number. In addition, add information regarding the matrix, sample location, depth, etc. to provide a complete description of the sample.

SAMPLE STORAGE PROCEDURE

- 1) Immediately after collection, placement in the proper container, and labeling, place samples to be retained for chemical analysis into resealable plastic bags.
- 2) Place bagged samples into an ice chest filled approximately half-full of bagged ice.
- 3) Maintain samples in an ice chest or in an alternative location (e.g. sample refrigerator) as approved by the Geomatrix Field Team Leader until time of shipment. Periodically drain melt water off coolers and replenish ice.
- 4) Ship samples on a daily basis, unless otherwise directed by the Geomatrix Field Team Leader.
- 5) Maintain appropriate custody procedures on coolers and other sample storage containers at all times. These procedures are discussed in detail in the Quality Assurance Project Plan.

SAMPLE SHIPPING PROCEDURE

- 1) Fill out the chain-of-custody form completely (see attached example) with all relevant information. The white original goes with the samples and should be placed in a resealable plastic bag and taped inside the sample cooler lid; the sampler should retain the copy.
- 2) Place a layer of inert cushioning material such as bubble pack in the bottom of cooler.
- 3) Place each bottle in a bubble wrap sleeve or other protective wrap. To the extent practicable, then place each bottle in a resealable plastic bag.
- 4) Place bottles in cooler with volatile organic analysis (VOA) vials near the center of the cooler.

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- 5) Pack bottles with ice in plastic bags. At packing completion, cooler should be at least 50 percent ice, by volume. Coolers should be completely filled, so that samples do not move excessively during shipping.
- 6) Tape cooler drain closed and wrap cooler completely with strapping tape in two or more locations to secure lid.
- 7) Place laboratory label address and overnight delivery waybill sleeves on cooler lid.
- 8) Place custody seal tape across the front or side seam between the lid and cooler body.
- 9) Sign the custody seal tape with an indelible soft-tip marker, then cover with an additional wrap of transparent strapping tape.
- 10) Place "Fragile" and "This Side Up" labels on all four sides of the cooler. "This Side Up" labels are yellow labels with a black arrow with the arrow head pointing toward the cooler lid.
- 11) For coolers shipped by overnight delivery, retain a copy of the shipping waybill, and attach to the chain-of-custody documentation.

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CALIBRATION AND MAINTENANCE OF PORTABLE FIELD pH METER

PURPOSE

This guideline describes a method for calibration of a portable pH meter. The pH meter measures the hydrogen ion concentration or acidity of a water sample (pH function). Calibration is performed to verify instrument accuracy and function. All field test equipment will be calibrated at the beginning of each sampling day, and checked and recalibrated according to the manufacturer's specifications. This procedure also documents critical maintenance activities for this meter.

ACCURACY

The calibrated accuracy of the pH meter will be:

pH ± 0.2 pH unit

CALIBRATION PROCEDURE

Note: Meters produced by different manufacturers may have different calibration procedures. These instructions will take precedence over the procedure provided here. This procedure is intended to be used as a general guideline, or in the absence of available manufacturer's instructions.

- 1) Obtain and activate the meter to be used. As stated above, initial calibrations will be performed at the beginning of each sampling day.
- 2) Immerse the sensing probe in a container of certified pH 7.0 buffer solution traceable to the National Bureau of Standards.
- 3) Measure the temperature of the buffer solution, and adjust the temperature setting accordingly.
- 4) Compare the meter reading to the known value of the buffer solution while stirring. If the reading obtained by the meter does not agree with the known value of the buffer solution, recalibrate the meter according to the manufacturer's instructions until the desired reading is obtained. This typically involves accessing and turning a dial or adjustment screw while measuring the pH of the buffer solution. The meter is adjusted until the meter reading agrees with the known solution pH.

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- 5) Repeat Steps 2 through 5 with a pH 10.0 buffer solution to provide if a two-point calibration is recommended by the manufacturer.
- 6) Document the calibration results and related information in the Project Field Book or Field Activity Daily Log. Information will include, at a minimum:
 - Time, date, and person performing the calibration
 - The unique identifier for the meter, including manufacturer, model, and unit
 - The brand and expiration dates of buffer solutions
 - The calibration readings
 - Corrective action taken (see Maintenance below) in the event of failure to adequately calibrate

MAINTENANCE

- When not in use, or between measurements, keep the pH probe immersed in or moist with buffer solutions.
- Check the meter batteries at the end of each day and recharge or replace as needed.
- Replace the pH probe any time that the meter response time becomes greater than two
 minutes or the metering system consistently fails to retain its calibrated accuracy for a
 minimum of ten sample measurements.
- If a replacement of the pH probe fails to resolve instrument response time and stability problems, obtain a replacement instrument (rental instruments) and/or order necessary repairs/adjustment.

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CALIBRATION CHECK AND MAINTENANCE OF PORTABLE SPECIFIC CONDUCTANCE METER

PURPOSE

This meter measures the ability of a water sample to conduct electricity, which is largely a function of the dissolved solids within the water. The instrument has been calibrated by the manufacturer according to factory specifications. This guideline presents a method for checking the factory calibration of a portable specific conductance meter. A calibration check is performed to verify instrument accuracy and function. All field test equipment will be checked at the beginning of each sampling day. This procedure also documents critical maintenance activities for this meter.

ACCURACY

The calibrated accuracy of the specific conductance meter will be within ± 1 percent of full-scale, with repeatability of ± 1 percent. The built-in cell, if used, will be automatically temperature compensated from at least 41° to 160° F (5° to 71°C).

CALIBRATION PROCEDURE

- 1) Field check the meter at the beginning of each sampling day.
- 2) Use a calibration solution of known specific conductivity and salinity. For maximum accuracy, use a Standard Solution Value closest to the samples to be tested.
- 3) Turn the Range Switch to 20 milliSiemens (mS) (also known as millimhos).
- 4) Insert the meter probe into a container of the calibration solution (note: do not use the solution bottle). Alternatively, depending on meter design, fill the meter's test cup with calibration solution.
- 5) If the reading obtained does not agree with the known specific conductivity of the solution, proceed as follows:
 - Clean the cell in accordance with the instruction manual. Rinse the cell thoroughly and repeat the calibration check.
 - If the meter still does not indicate the correct value, recalibrate the meter in accordance with the manufacturer's instructions. This typically involves

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accessing and turning a dial or adjustment screw while measuring the conductance of the calibration solution. The meter is adjusted until the output agrees with the known solution conductance.

- If calibration cannot be achieved or maintained, obtain a replacement instrument (rental instruments) and/or order necessary repairs/adjustment.
- 6) Document the calibration check results and related information in the Project Field Book or FADL. Information will include, at a minimum:
 - Time, date, and person performing the calibration
 - The unique identifier for the meter, including manufacturer, model, and unit
 - The brand and expiration dates of calibration solutions
 - The calibration readings
 - The approximate response time
 - The overall adequacy of calibration
 - Corrective action taken (see Step 5 above) in the event of failure to adequately calibrate

MAINTENANCE

- Check the meter batteries at the end of each day and replace when needed.
- Track the meter response time and stability to determine the need for instrument maintenance. When response time becomes greater than two minutes and the meter must be recalibrated more than once per day, send the instrument to the manufacturer for maintenance and repair.

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CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

PURPOSE

This procedure describes a general method for calibration and maintenance of a portable photoionization detector (PID). The PID detects and initially quantifies a reading of the volatile organic compound (VOC) concentration in air. The PID is used as a field screening tool for initial evaluation of soil samples and for ambient air monitoring. In order to ensure an accurate reading, the PID must be calibrated prior to use in the field.

The information included below is equipment manufacturer- and model-specific, however, accuracy, calibration, and maintenance procedures for this type of portable equipment are typically similar. The information below pertains to the Thermoenvironmental Instruments Inc. Model 580-B photoionization detector. The actual equipment to be used in the field will be equivalent or similar.

The PID indicates total VOC concentration readings which are normalized to an isobutylene standard, so actual quantification of individual compounds is not provided. In addition, the PID response to compounds is highly variable, dependent on ionization potential of the compound, and the presence or absence of other compounds.

PROCEDURE

- 1) Calibrate all field test equipment at the beginning of each sampling day and check and recalibrate according to the manufacture's specifications.
- 2) Calibrate the PID meter using a compressed gas cylinder containing a 100 ppmv isobutylene standard, a flow regulator, and a tubing assembly. In addition, a compressed gas cylinder containing zero air ("clean" air) may be required if ambient air conditions do not permit calibration to "clean air".
- 3) Assemble the calibration equipment and actuate the PID in its calibration mode. Insert the PID probe into the zero air calibration assembly (or calibrate to ambient air if conditions permit) and wait for a stable indication.
- 4) Calibrate to 100ppmv with isobutylene standard.

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5) Document all instrument calibrations in the Project Field documents, indicating the meter readings before and after the instrument has been adjusted. This is important, not only for data validation, but also to establish maintenance schedules and component replacement.

MAINTENANCE

- The probe and dust filter of the PID should be checked before and after every use for cleanliness. Should instrument response become unstable, recalibration should be performed. If this does not resolve the problem, access the photoionization bulb and clean with the manufacturer-supplied abrasive compound, then recalibrate.
- The PID battery must be recharged after each use. Store the PID in its carrying case when not in use. Additional maintenance details related to individual components of the FID are provided in the equipment manufacturer's instruction manual. If calibration or instrument performance is not in accordance with specifications, send the instrument to the equipment manufacturer for repair.

Maintain a log for each monitoring instrument. Record all maintenance performed on the instrument on this log with date and name of the organization performing the maintenance

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PRESSURE TRANSDUCER INSTALLATION PROCEDURE

PURPOSE

Installation of transducers in wells or peizometers for data acquisition during aquifer testing or water level monitoring. This method is directed toward vented transducers; use of unvented transducers may require acquisition of barometric data for some purposes.

PROCEDURE

- 1) Measure the water level in piezometer or well from datum mark using e-line.
- 2) Lower cleaned vented pressure transducers into the well or piezometer to a depth greater than the expected drawdown at the location
- 3) Secure transducer by attaching cable to docking ring or similar surface structure.
- 4) Once installed, and prior to activating the logger, read the pressure output (as submergence in feet of water) and record in the field log. If well has sufficient diameter, use the electric sounder to manually re-measure the water level in the well and record reading.
- 5) Add depth to water and electronic submergence measurements to calculate depth to transducer.
- 6) Synchronize the computer and data logger clock times and note this on the field log. To verify the sensitivity of each transducer use the following procedure:
 - measure a one- to two-foot increment on the transducer cable and raise the transducer by this amount;
 - check the pressure reading to verify that it changed by the amount the transducer was raised.
- 7) Activate the transducers in each well to measure and record water pressure at one-minute interval (one minute is a reasonable default interval for most tests).
- 8) Transducers in all wells should be set to begin logging at the same time (e.g., on the quarter hour) for ease in data reduction. Note the time of transducer activation on the aquifer test form and the field log.

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TRANSDUCER INSTALLATION PROCEDURE

PURPOSE

PROCEDURE

The following procedure will be used:

- 1) Measure the water level in piezometer or well from datum mark using e-line.
- 2) Lower cleaned vented pressure transducers into the wells to a depth greater than the expected drawdown of the well.
- 3) Install transducer by securing cable to docking ring.
- 4) Once installed, and prior to activating the logger, read the pressure output (as submergence in feet of water) and record in the field log. If well has sufficient diameter, use the electric sounder to manually re-measure the water level in the well and record reading.
- 5) Add depth to water and electronic submergence measurements to calculate depth to transducer.
- 6) Synchronize the computer and data logger clock times and note this on the field log. To verify the sensitivity of each transducer use the following procedure:
 - measure a one- to two-foot increment on the transducer cable and raise the transducer by this amount;
 - check the pressure reading to verify that it changed by the amount the transducer was raised.
- 7) Activate the transducers in each well to measure and record water pressure at one-minute intervals.
- 8) Transducers in all wells should be set to begin logging at the same time (e.g. on the quarter hour) for ease in data reduction.

Note the time of transducer activation on the aquifer test form and the field log \AUST1\Project\8269\TskA - Work Plan\FOP TIP.doc

APPENDIX B

Field Forms

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Forms(PF).012 (Revised 12/95)																						

WATER LEVEL MONITORING RECORD



Project I	Name:			F	Project and Ta	ısk Number:		
Date: _		Mea	sured by:			Instrum	ent Used:	
P =	Pumping	=	Inaccessible	obreviations n D nder MP	= Dedicated	l Pump g Point	WL = Water	Level
Well No.	Time	MP Elevation (feet)	Water Level Below MP (feet)	Water Level Elevation (feet)	Previous Water Level Below MP		Remarks	
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Forms(PF).007 (Revised 12/95)

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SAMPLE CONTROL LOG	lame:	Project and Task No.:	Sampling Time											*
SAMP	Project Name:	Project a	Sampling Date											



WELL SAMPLING AND/OR DEVELOPMENT RECORD

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	Depth of Periorated Interval Below Top of Casing.			
	Well Design:	Cons	struction Time I	₋og:
	Geologic LogGeophysical Log	Task	Start	l Finish
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PHOT LOG

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DAILY FIELD RECORD Page _____ of ____ Project and Task Number: Date: Project Name: Field Activity Location: Weather: ∋ of OVM Calibration: PERSONNEL: Tyvek Coveralls Steel-toed Boots Hard Hat Rubber Gloves Safety Goggles 1/2-Face Respirator

FIELD INSTRUMENT CALIBRATION SHEET



Project Name:	Project Number:	
Date:		
Equipment Type:		
Manufacturer:	•	
Model Number:	Serial Number:	
Calibration (as necessary, minimum twice per day):		
Calibration #1	Time:	
Calibration Standard:		
Instrument Reading:		
Calibration #2	Time:	
Calibration Standard:		
Instrument Reading:		
Calibration #3	Time:	
Calibration Standard:	·	
Instrument Reading:		
Calibration #4	Time:	
Calibration Standard:		
Instrument Reading:		
Date of Last Calibration:	Date(s) Instrument Used:	
Name of person(s) who calibrated instruments:		
Calibration Standards Used:		
(1)		
(2)		
(3)	· ·	
(4)		
Source of Calibration Standards:		
Misc. Comments:		
C	alibrated by:	

PROJECT HEALTH AND SAFETY FIELD MEETING FORM

Date:	Time:	Project No.
Project Name:		
Location:		
Meeting Conducted by:		
Topics Discussed:		
Physical Hazards:		
Chemical Hazards:		
Personal Protection:	-	
Decomanimation.		
Special Site Considerations:		
- The state of the		
Check List:		
1. Emergency information rev	iewed and made fami	liar to all team members?
2. Location of nearest hospita	l known to all team m	embers?
3. Site Safety Plan readily ava	ailable and its location	known to all team members?
•	Attendee	
Name/Company (-
Trains Company	prince)	Signature
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	,	
	<u> </u>	
Meeting conducted by:		
Signat	ure	

APPENDIX C

ATEC Construction Drawings